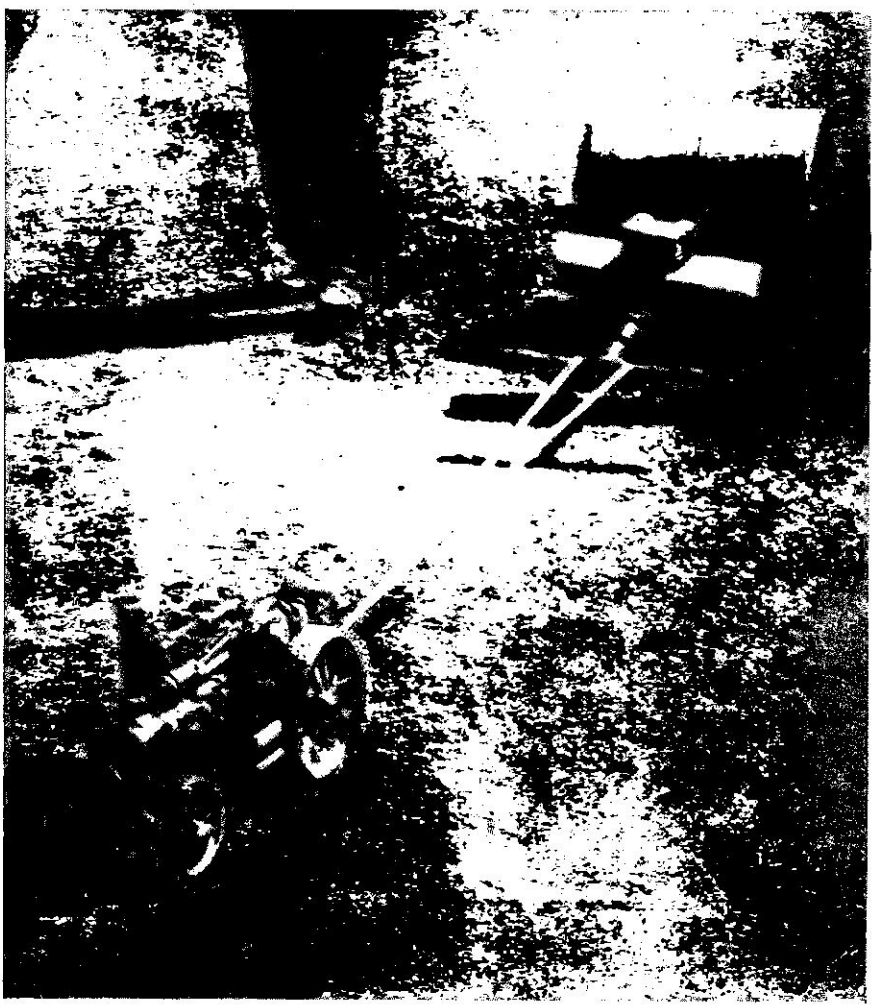
THE MODEL ENGINEER

Vol. 94 No. 2334 THURSDAY JANUARY 31 1946 6d



It is cheaper than horse-power! The 1-in. scale, 47-lb. "Jix," built by Mr. A. E. Phillips, of Birmingham, hauling the 2½-cwt. roller on a local bowling-green

ELECTRADIX

TRANSFORMERS.
3 kW Crypto 230 V. to 15 V., shrouded, **£9 10s.**, 3 kW Metvick, 50-cycle, 400 V. to 600 V., **£9 10s.** 1 kW Powquip 50-cycle, 250 V. to 50 V., 20 amps, **£7**, 500-watt Foster 50-cycle, 440 V. to 110 V., 5 amps, **£4 15s.**, 150-watt Foster 400-cycle, 230 V. to 15 V., 10 amps, **£2 15s.** 5 watts H.T. test Transformers 110/220 V. to 1,000 V., 5 ma., **10/-**. Current transformers for meters. Various sizes in stock.

TRANSFORMER PARTS.
A limited number of shrouded transformer carcases for rewinding, 3-kW. size, with laminations, first-class make, **45 -.** ½ kW shrouded, with several taps, output unmarked, contain 60 pairs T. & U. stampings, 4 lb., 20 D.C.C. wire, 2½ lb., 8 D.C.C. wire in short lengths ; size : 6½ x 5⅝", **65 -.**

SMALL MOTOR GENERATORS.
By E.D.C. and others. Pocket size for use in receivers to take the place of H.T. Battery, will drive off 12-volt accumulator, output 230 V. 30 ma., off 6 volt, gives output of 110 V. 15 ma. Beautifully made for Government radios. In new condition, **75 -.**

MOTOR PUMPS.
Immediate delivery of the famous Stuart-Turner 12-volt D.C. motor pumps ; 120 gallons per hour, **84 -.** 230 volts A.C. D.C. Lesdix Model, **£5 10s.**

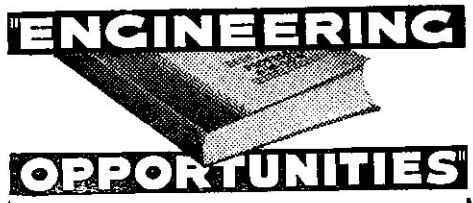
A.C. MOTORS, 230 volts ; new, ¼ and ⅓ h.p., for prompt delivery. **MAGNETOS.** Type "A," by E.I.C., with advance and retard arm, **45 -. ALTERNATORS.** Perm. magnet, hand drive, 80 V. 25 ma., **10 6.**

PETROL FILTERS.—ENOT'S brass petrol filters, with union, **7 6. G.P.O. LABORATORY SWITCHES.**—D.P. reversing, for model control, motors and test work, **7 6.**

G.P.O. ELECTRIC COUNTERS.—25/50 volts D.C., 500 ohm coil, counting to 9,999, **5/6.**

MOTORS, DYNAMOS, SWITCHBOARDS, CHARGERS, ETC.
You are invited to visit our showrooms. A large and varied range of Electrical, Mechanical and Radio equipment is available.

Electradix Radios
214, Queenstown Road, London, S.W.8
Telephone : MACAULAY 2159



IMPORTANT GUIDE

This unique handbook, "**Engineering Opportunities,**" shows the easy way to secure A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., A.M.Brit.I.R.E., City & Guilds, A.M.I.A.E., etc.

We guarantee—
"NO PASS—NO FEE"

Details are given of over 150 Diploma Courses in all branches of **Civil, Mechanical, Electrical, Automobile, Aeronautical, Radio, Television and Production Engineering, Draughtsmanship, Tracing, Inspection, Building, Government Employment, R.A.F. Maths, MATRIC,** etc.

A copy of this enlightening guide to well-paid posts will be sent on request—**FREE and without obligation.**

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY
13, Shakespeare House,
17, Stratford Place, LONDON, W.1

The Leading Monthly Journal for Constructors

is

"MODEL RAILWAY NEWS"

DEVOTED TO THE PLANNING AND CONSTRUCTION OF MODEL RAILWAYS, INCLUDING ENGINES, ROLLING STOCK AND ALL ACCESSORIES FOR STEAM, ELECTRIC AND CLOCKWORK SYSTEMS.

Published Monthly. Price 9d. Annual Subscription 10s. 6d.

Copies are normally obtainable through your newsagent, but owing to paper rationing most suppliers now have a waiting list of subscribers. In case of difficulty write to the publishers:

PERCIVAL MARSHALL & CO. LTD.,
23, Great Queen Street, London, W.C.2,
and at Cordwallis Works, Maidenhead, Berks.

"PATHFINDER" AEROCASTINGS

The new one-piece metal solid die-cast in light alloy.

Make a replica to be proud of.

"Pathfinder" Aerocastings being die-cast are superior to the ordinary sand casting. Guaranteed free from casting flaws, blow-holes, etc. Easily worked with file and emery-cloth. Produces beautiful silver finish.

"A FIRESIDE HOBBY FOR ALL."

GOOD NEWS!

Scale		
Spitfire ...	1/72"	All one price, 2/6 per casting.
Hurricane...	,,	
Tempest ...	,,	
Typhoon ...	,,	
Mustang ...	,,	
Thunderbolt	,,	
Corsair ...	,,	
Firefly ...	,,	
Wellington	1/144"	

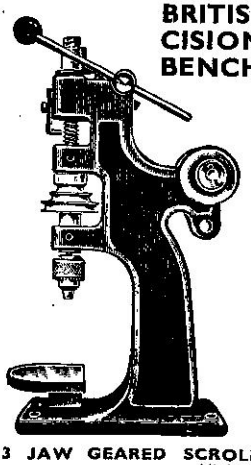
1946 PRICE REDUCTION.

Scale		
Mosquito	1/72"	3/6
Beaufighter	,,	,,
Lightning	1/72"	All one price, 5/- per casting.
Halifax ...	1/144"	
Lancaster	,,	
Stirling ...	,,	
Fortress ...	,,	

Small Ashtrays, 2/- each. Large Ashtrays, 3/- each.
Dural Rods for mounting the models, 3d. each.
Postage, 6d. extra single models. Two or more, 1/-
From all good model shops or direct. Send cash with order.

(S.A.E. for List) to—

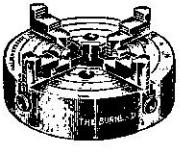
"PATHFINDER" AEROCASTINGS
7, PARK AVENUE, BELFAST.



BRITISH MADE PRECISION SENSITIVE BENCH DRILLING MACHINES

Ideal for Model Engineers. Fitted with genuine Jacobs 3 Jaw Chuck, capacity 0-¼". Ball thrust 3 speed spindle to back 2½". Adjustable table 5⅜". Price complete, **£7/11/-** ¼" H.P. motor if required, **£5/5/-**, complete with pulley. Delivery from stock.

3 JAW GEARED SCROLL LATHE CHUCKS



High-grade Nickel Chrome Steel Scrolls. Alloy Steel Pinions. Complete with 2 Sets of Jaws (Internal and External), 4in. diam., **£3/12/6**; 6in. diam., **£4/12/6**; 7½in. diam., **£5/5/-**. Independent 4 Jaw Chucks with Reversible Jaws, as illustration. 3½in. diam., **39/6**; 4in. diam., **41/-**; 4½in. diam., **48/9**.

DELIVERY EX STOCK

We have good stocks of all kinds of engineers' tools & equipment and welcome your enquiries for our earnest attention. Write, phone or call

S. TYZACK & SON LTD.
341-345 OLD STREET E.C.1.
CLERKENWELL 4074-5-6

Join the Well-Paid Ranks of the I.C.S. TRAINED MEN

What about your future? What of the new great world of to-day? There are marvellous opportunities, but only for those who have had specialised training. One thing is certain—there is not, and never will be, a worth-while place for the untrained.

Ambitious men everywhere have succeeded through I.C.S. Home-Study Courses. So also can you. We offer you the benefit of our 54 years' matchless experience as creative pioneers of technical instruction by post.

Write to the I.C.S. Advisory Dept. stating your requirements. Our advice is free.

Here are some of the subjects in which we offer thoroughly sound instructions:

ACCOUNTANCY
ADVERTISING
AERONAUTICAL ENG.
AEROPLANE DESIGN
AIRCRAFT ENG.
ARCHITECTURE
ARCH. DRAWING
BOILERMAKING
BOOK-KEEPING
BUILDING
BUILDING SPECIF.
BUSINESS TRAINING
CHEMISTRY, INORG. AND ORGANIC
CIVIL ENG.
CLERK OF WORKS
COMMERCIAL ART
CONCRETE ENG.
DIESEL ENGINES
DRAUGHTSMANSHIP (State which branch)
DRAWING OFFICE PRAC.
ELECTRICAL ENG.
ELECTRIC POWER, LIGHTING, TRANSMISSION, TRACTION
ENGINEER-IN-CHARGE
ENG. SHOP PRACTICE
FIRE ENGINEERIN
FUEL TECHNOLOGY
GARAGE M'G'MENT
GAS-POWER ENG.
HEATING & VENT.
HYDRAULIC ENG.
JOURNALISM
MACHINE DESIGNING
MACHINE-TOOL W'K
MARINE ENG.
MECHANICAL ENG.
MECH. DRAWING
MINING ELECTRICAL
MOTOR ENGINEERING
MOTOR VEHICLE ELEC.
MOULDING
PLASTICS
PLUMBING
QUANTITY SURVEY'G
RADIO ENGINEERING
RADIO SERVICE ENG.
REFRIGERATION
SALESMANSHIP
SANITARY ENG.
SCIENTIFIC M'G'MENT
SECRETARIAL WORK
SHEET-METAL WORK
SHORT-STORY WR'T'G.
STEAM ENGINEERING
STRUCTURAL STEELWORK
SURVEYING (State which branch)
TELEGRAPH ENG.
TELEPHONE ENG.
WATER-POWER ELEC.
WELDING
WOODWORKING
WORKS ENGINEERING
WORKS M'G'MENT

EXAMS.: E.J.B.C. Prelim., I.Mech.E., I.Fire.E., C. & G. Motor Vehicle, B.Inst. Radio Eng., P.M.G. Wireless Operators, B.O.T. Certificates, I.Elec.E., C. & G. Elec., R.I.B.A., London Matric. and many others.

Special terms for members of H.M. Forces and discharged disabled members of H.M. Armed Forces.

YOU MAY USE THIS COUPON

INTERNATIONAL CORRESPONDENCE SCHOOLS

Dept. 53, International Buildings, Kingsway, London, W.C.2.

Please send me particulars of your Courses in

.....

Name..... **Age**.....

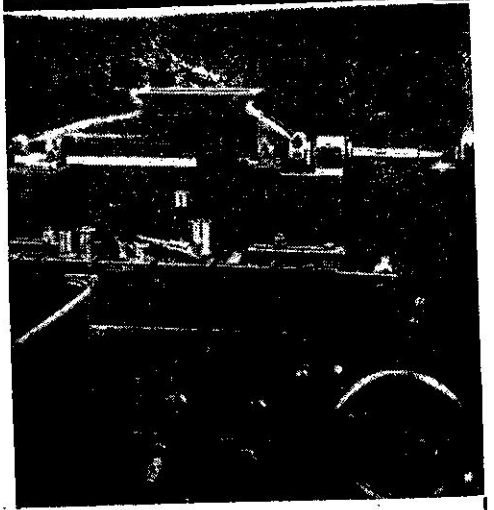
Address .....

.....

(Use penny stamp on unsealed envelope)

ICS

HOW MYFORD LATHES ARE MADE 3



Let's get this Straight

We take quite a lot of trouble with this operation —boring the leadscrew bearings—and use very special equipment. First, we mount the Lathe Bed face downwards in a jig to ensure correct location from its top surface and inner slideways.

The boring, reaming and facing of the bearing housings at each end of the Bed are carried out at one setting on this special twin-head machine, thus ensuring complete accuracy of alignment.

MYFORD Lathes

MYFORD ENGINEERING COMPANY LIMITED
BEESTON · NOTTINGHAM · Phone: 54222 (3 lines)

78.88

SELF-CENTRING 2½-INCH 3-JAW SCROLL CHUCK, WITH REVERSIBLE JAWS

This Chuck, the latest addition to the range, has been designed expressly for Instrument and Watchmakers' Lathes with the high accuracy demanded by this style of work.

SPECIFICATION

WEIGHT OF CHUCK is **10 ozs.** only.

FITTED TO LATHES by means of an **ADAPTOR**, which is drawn into collet chuck, in place of split collet. They can, however, be fitted to a normal threaded mandrel-nose with a special backplate.

Model No. 32

Diameter of Body	2½ in.
Diameter of hole through Body	⅝ "
Diameter of Backplate recess	.4725 "
Width of Body	⅜ "
Projection of Jaws from Body	⅜ "
Approximate weight	10 ozs.
PRICE COMPLETE WITH ONE SET OF REVERSIBLE JAWS	78/9
SPECIAL BACKPLATE	26/3

Per C.O.D. from :—

GARNER'S, SHEFFIELD ROAD, BARNSLEY.

'Phone : 2866.

The Finest ENGINEERS' TOOLS and LARGEST STOCK IN LONDON

obtainable from **BUCK & RYAN Ltd.**

LATHES
MICROMETERS
CALIPERS . GAUGES
SQUARES . TAPS & DIES
MILLING CUTTERS

THE "TOOL PEOPLE,"
310-312, Euston Road, N.W.1
and at
261, Edgware Rd., W.2
LONDON

"UNO" PEN STENCILS IN STOCK

Send for "Uno" list. Price (with post) 3d.

No Tool List available. *Quotations sent on request.*

Enquiries by 'Phone : EUSTON 4661.

FINISHED PARTS FOR MODEL LOCOMOTIVES

CASTINGS, PATTERNS, MATERIALS

WE SPECIALISE IN SMALL TURNING, MILLING AND GRINDING TO FINE LIMITS. REPETITION OR OTHERWISE.

MODELS BOUGHT AND SOLD

LUMSDEN INSTRUMENTS
167, Fulham Road, S.W.3.

THE MODEL ENGINEER

Vol. 94 No. 2334 Percival Marshall & Co., Limited Cordwallis Works, Maidenhead January 31st, 1946

Smoke Rings

Model Racing Cars on the Air

THIS does not imply that model racing cars are being fitted with wings, but refers to an interesting broadcast recently put over by the B.B.C. It was an item included in a new magazine programme which started with the voice of the announcer saying "Now listen to this." Then followed the roar of a model car at speed, familiar enough to those who have heard any model petrol engine doing its revs., but certainly an impressive introduction of the subject to the listener, and a novelty in radio noises. This was followed by a commentary by Mr. E. T. Westbury on the actual running of a model car, and an instructive explanation of what model car constructors are aiming at, and the remarkable results they are achieving. I think listeners must have been astonished to learn that in racing round the pole the speeds were such that a lap was covered in about two seconds. But if the speeds were surprising, so was the diminutive size of the engines used. Mr. Westbury brought this out very effectively by mentioning that the diameter of a 5-c.c. engine was represented by a sixpence, and that the cylinder of a 10-h.p. car had a volume of 1,000 cubic centimetres against the 5-c.c. of a miniature car engine. A model car builder added a short talk about the details of a car he had constructed, and so, in this very practical fashion, model racing cars took the air to the delight of many thousands of listeners. When television is resumed the public will be able to see at their own fireside not only model car racing but the equally attractive spectacle of speed boat regattas and locomotive and passenger tracks in full operation. Meanwhile, congratulations to the B.B.C. for their continued interest in the fascination of mechanics in miniature.

Accuracy in the Workshop

A VISIT to the most interesting show recently staged by the Gauge and Tool Makers' Association, at the New Horticultural Hall, brought home to me the remarkable facilities for exact measurement and interchangeable production which are now available to the engineering world. From the comparatively simple micrometer measuring to a thou., or even a ten-thou., a whole family of measuring devices has developed, extending even to appliances which will demonstrate a variation in size of the millionth of an inch. A millionth may not be a very practical or even desirable limit in ordinary workshop procedure, but in research work it will be a very illuminating factor in promoting knowledge. "Near enough" has given way to "exactly right" in the workshop, and the skill and ingenuity of the gauge and toolmaker is exercising a vast influence on the reputation of British engineering for perfection, and in adding immeasurably to the ease with which accurate work can be produced.

What Model Engineers Want

IN setting the wheels of his business going again after the war period, Mr. Charles A. Cole, of Ventura, California, has taken the sensible step of issuing a questionnaire to his customers, asking them to define the services they need. One of the questions asked was—are there any special models or supplies which you would like to have us list in our catalogue? In the replies live steam locomotives led the voting, but here are some of the other things for which the customers expressed a desire—military and naval equipment and guns, old style electric generators and power plants, diesel engines, steam turbines, Corliss engines, old-time steam engines of any kind, agricultural implements, saw mills, oil well drilling equipment, and hot-air engines. I should imagine it will be difficult for Mr. Cole to cater for all these very diverse requirements, but they certainly show that model engineering is very far from being in a groove in the United States.

Model Makers Wanted

A LETTER from the Hon. General Secretary of the Institute of Patentees, 25, Victoria Street, S.W.1, tells me that many of his members require the services of model makers and experimental engineers in connection with their inventions. Readers who are prepared to undertake work of this kind should write in to the above address, stating the equipment available and the work they can deal with.

Black Finish on Wood

A LARGE number of readers replied to the recent query on this subject, and all are cordially thanked for their helpful suggestions, which have duly been forwarded to our querist. Some experimenting appears to be called for, and if any really satisfactory results are obtained, we shall probably publish the recipe.

Percival Marshall

Power Boating up North

By T. R. BARNETT

SOME time ago I received a letter from Mr. Percival Marshall, of THE MODEL ENGINEER, informing me that my last contribution was a war casualty. Although our boat-house was damaged, and even our flag-staff blown down, in three pieces, the head-quarters of P.B.U.N., at Tynemouth Park, like THE MODEL ENGINEER, refused to take the count; through all those dark years our regattas were held as usual, and we have sailed into peace again with a large increase in membership and a substantial bank balance. It appears that the other four North-East Clubs were practically closed down; but I understand that things are now on the move again, and, as championship holders, we are all ready for the challenge when it does come along.

The Tynemouth Club, with a membership of sixty-four, is one of the largest clubs in the country; we also have a waiting-list, as all new members are elected by the Executive Committee, after a probationary period. There are three sections, power boats, hydroplanes, and sailing yachts, with a captain, who is an expert, in charge of each section. Several of our members are what we call three-section men, owning power boats, hydroplanes, and sailing yachts, and take part in all our competitions.

Mr. Fred Cook, with his steam model "Tigress," a good-looking craft, is a well-known northern enthusiast, and an artist by profession, he is certainly an artist regarding model power boats, building all his own models. He owns "Tigress," steam, "Mercury," petrol motor, hydroplanes and sailing yachts, takes part in all our competitions with much success, having won two cups this season for steering with his steam model. Mr. Cook has adopted the "no rudder" system, same as my own model "Jane," already fully described in THE MODEL ENGINEER, some years ago. To do this, the model is balanced by a movable weight inside the hull, but it is essential that balancing is done at the revolutions it is intended to run the engine, i.e., the engine should be full opened out and steam maintained at full pressure with a few pops at the safety-valve, if anything. With these conditions, and the right type of boat, long, and not too much beam, as low as possible in the water to stand up to rough weather, no superstructure, to dodge a cross-wind, and you have a straight runner, with no rudder to get knocked at the lakeside, or when in transit to foreign waters.

"Tigress" has a sun engine, pot boiler 9 in. × 3 in. barrel, with 28 ⅜ in. flue tubes, all copper. This type of boiler is a tube with small tubes passing through the barrel vertically like the furnace of a centre flue boiler with ends to take water gauge, check-valve, etc., and this is enclosed in a casing with one end of boiler projecting, to take fittings. Boiler must be all brazed, as it is all in contact with the blow-lamp and feed-pump on the engine is absolutely necessary for continuous feed, as there is no reserve of steam or water, which makes them complicated for the prospective young ship-owner.

The working pressure is 100 lb., and the blow-lamp has two nipples with oval tube, to produce a large flame.

"Tigress" has won two cups this season for steering, but Mr. Cook deserves his success, as he spends all his time at the lake, spare time, of course, and although we have not caught him, many of our members contend that he has a bunk in the boathouse.

The writer is a pure steamboat enthusiast, as old readers will know, and we find, up North, that the steering competition provides a thorough test for model power boats. Our target consists of six flag-poles spaced four feet apart, in a straight line across the lake, facing the starting platform. The centre space counts 20 points, next two spaces, either side, 15 points, and outer, 10 points. The bull's-eye, which we all aim for, is a round metal disc, mounted on a pole, and placed ten feet behind the centre space. The starting platform is 75 yds. from the target, and all models must pass through two flag-poles 8 ft. apart, and 10 ft. in front of the starting platform.

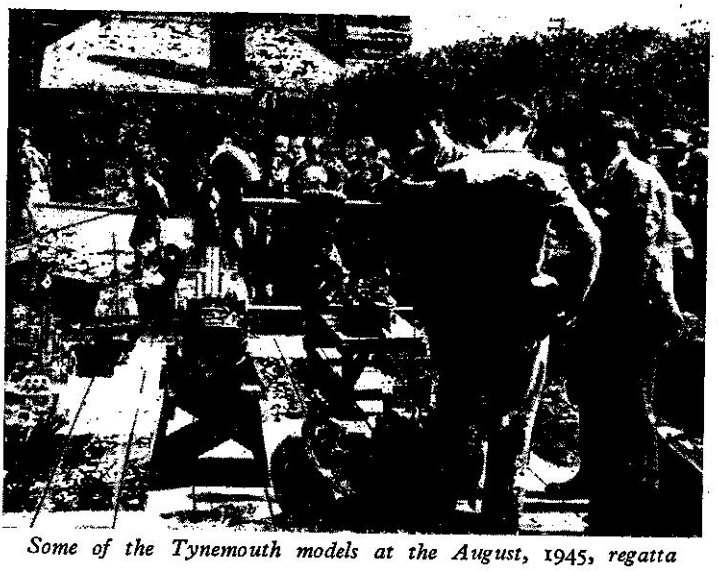
Now I understand that the London course is only 40 yds.; that great power-boat enthusiast, Mr. E. W. Vanner, of Victoria M.S.B.C., discovered the difference of that extra 35 yds. when he paid us a visit with his two models, *Bon Ami* and *Leda III*, in August, 1927, and ran in our big meeting of all the North-East clubs. That was a great day, and the local papers estimated 6,000 spectators around the lake.

Time marches on, and season 1945 has been a very active one; we have run twelve competitions and the final power-boat regatta was held on August 26th. We have collected £27 at the lake-side for Tynemouth Infirmary; a brief description of our last regatta may interest other power-boat clubs.

The weather was splendid, and we decided to anchor the models around the lake-side until lunch time. On view, were models of battleship, cruiser, T.B. destroyers, T gunboat, naval pinnace and a submarine, which was a good representation of our great Navy. Also liners, cargo-boats, tugboats, cabin-cruiser, steam yachts, and numerous speed-boat types of craft, specially designed for the steering competition, some 27 models all belonging to the Tynemouth Club. The Sunderland Club promised to bring some models through, but we were disappointed and Mr. Holbrook, the secretary, told me at the regatta, that they could not rake up a single model, as many were in dry dock, and owners were away on holiday. We hope Sunderland will have

so I appeal to the younger members to come forward and take an active part. I was actually able to run my model, "Jane," for the first time this season, owing to much-improved assistance.

There were 14 entries, and competition started at 1 p.m. Owing to weeds, many of our crack boats fared badly, and it appeared that scores would be low, as a winner usually reaches 55 points. Mr. F. Cook's "Tigress" (steam) retired after two runs and



Some of the Tynemouth models at the August, 1945, regatta

those models ready for 1946!

Anchors were weighed at 12 noon, and the models, varying from 4 ft. to 7 ft. in length, and weights from 30 lb. to 250 lb., were removed from the lake and prepared for running. Judges, starter, and catchers were appointed; no doubt, many power-boat clubs, like our own, have a large percentage of members of the "spectator" variety, who leave all the work to a few willing and sometimes harassed officials,

no score, and his petrol motor model "Mercury" also missed the target three times. Mr. A. McEwan's "Joan," one of our best motor boats, also failed to score. "Fury," Mr. F. L. Davis' steam T.B.D., retired with engine trouble, after one run. Some excitement was caused when Mr. A. Irving's "Dart," after scoring two 15s, stopped a few yards in front of the target and actually drifted through the 15 again, to make 45, which was the highest score, and 1st prize. Mr. S. H. Walker's "Princess Ida" was 2nd, with 35 points. The "Spray" and "Jane" tied for 3rd prize with 25 points each. These tie runs are always exciting, as this dual between Mr. A. Irving Senior, and the writer, two old steamboat veterans, proved to be. I was first off and scored a "bull," which I thought would settle the issue. But one never knows, and there was more excitement when "Spray" also scored a "bull," which meant another run. While I was fixing up a little blow-lamp trouble, "Spray" was off again, and I could not see the score when my catcher whispered in my ear, "ten to beat." However, "Jane" was getting into her stride after her long spell in dry dock, and scored another "bull" with much handclapping. Our chairman, Mr. F. L. Davies, presented the prizes, and so ended the last power boat competition for season 1945.

Our lake is 180 yd. long and 100 yd. wide, pretty large for a park, and during the steering competition, the hydroplanes were also whizzing around the pole at the top end of the lake, in charge of Mr. L. G. Brough, our hydroplane expert. Mr. Brough also has a fine wireless-controlled model liner, 6 ft. long, which has done some splendid running, but had to be put in dry dock during the war years. We were pleased to welcome a visitor, Mr. W. H. T. Meageen, from Workington, in Cumberland, who brought a really first-class hydroplane. He had some trouble, and I noticed him in the boathouse, with the motor all opened out; but afterwards I saw her lapping around the pole at 30 miles per hour, which is about the speed of the best at Tynemouth. This, our youngest section, has much to learn to reach the high speeds of our London shipmates, but I feel sure they will, some day, reach our steering records.

I have memories of my great reception in New York, and the very happy time I had among American model engineers many years ago, during my world travels, and we were delighted to welcome to Tyneside, Ed. de Gear, 6-ft. 2-in. airman of the U.S.A. "Nite Fiter" Squadron, all the way from San Francisco Model Engineering Society. He is a keen power boat enthusiast and was bewailing the fact that, despite his searching, he had not seen any power boats, and wrote to THE MODEL ENGINEER, who told him to try Tynemouth; I feel sure he would be more than satisfied with his visits and the models he saw in action on our lake.

After lunch, de Gear was very anxious to know how we made such a good job of our metal-plated hulls, as all theirs were built of wood; so I produced a pile of back numbers of THE MODEL ENGINEER for his perusal, which I hoped would not make him think how easy it was to build a really good plated hull. Mr. Brough told me that our visitor gave him some valuable tips about electrical gadgets for hydroplanes. When I said good-bye at the station, de Gear said that he would sure have something to tell the boys back home about his visits to Tyneside, where the big ships are built, and also the models for power boating up North.

(To be continued)

For the Bookshelf

Hurricane, by F. H. M. Lloyd. (The Harborough Publishing Co. Ltd., Allen House, Newarke Street, Leicester.) Price 7s. 6d. net.

Events move so rapidly these days that we are often surprised to discover that something which we have come to regard as a matter of everyday familiarity has suddenly become quite the reverse. A striking instance is to be found in the "Hurricane" aeroplane, a machine which, it seems, only yesterday, was as permanent a feature of our Air Force as seaweed is of the ocean. It comes as a shock to learn that the "Hurricane" is now obsolete, the last one having been built in September, 1944.

Mr. Lloyd has written a timely and most interesting history of this famous aeroplane, from the completion of the first example in November, 1935. The story cannot fail to stir the imagination and enthusiasm of all readers who were thrilled by the many amazing exploits of the "Hurricane" during the war; it has set a standard that must now become a tradition in the R.A.F. And with it goes a fine record of skill, patience, daring and endurance on the part of all who have been in any way associated with the design, construction, operation and maintenance of one of the world's most remarkable aeroplanes. The book is fully illustrated.

Aircraft of the Fighting Powers, Volume VI. (The Harborough Publishing Co. Ltd., The Aerodrome, Billington Road, Stanbridge, near Leighton Buzzard, Beds.) Price 31s. 6d. net.

Although this sixth volume of what has become a well-known series is produced after all the fighting has ceased, it comes at a time in which there should be no relaxation of the desire that Britain should retain her position as a Power in the air. This volume describes and illustrates no fewer than seventy-two different types of aircraft which have been produced during 1945, and it can scarcely fail to stir the enthusiasm of air-minded readers.

A "Reader" Steam Engine

By P. L. FEWKES

I HAVE been extremely interested by comments made by various contributors in THE MODEL ENGINEER from time to time on the subject of the decline in popularity of the steam engine.

Whilst I agree that this may have some foundation as far as the large horizontal mill-type engine is concerned, I would hasten to assure the sceptic that its modern counterpart, the high-speed enclosed forced lubricated type, is still on the ascendant in its many industrial applications. Increased economy in steam consumption and the advent of oil-free exhaust have opened up many new fields, excellent examples of which can be found in chemical and gas works, laundries, institutions, etc.; in fact, anywhere steam is generated. Basically, the principle is to use the engine as a reducing valve; that is, high-pressure steam at the stop-valve is converted into power for industrial drive or electric power generation, whilst the exhaust steam, which can be to any predetermined pressure, can be utilised for process work. This can, if necessary, come in direct contact with, say, food products, as it is in no way contaminated, not having come in contact with oil during its passage through the engine.

In the marine field, steam auxiliaries are firmly established, to what extent can be envisaged by the fact that steam-driven reciprocating generating, pumping and refrigerating sets are to be found in the latest diesel-engined vessels. In this case, of course, steam is generated in waste-heat boilers fired by exhaust gases from the main drive. Truly, I think it can be said that, with careful application, the modern high-speed steam engine can effect economies that far surpass its I.C., C.I., and electric competitors; and, with steam engine manufacturers continually experimenting and developing their productions, a future is assured for some considerable time. My interest in reciprocating steam power units

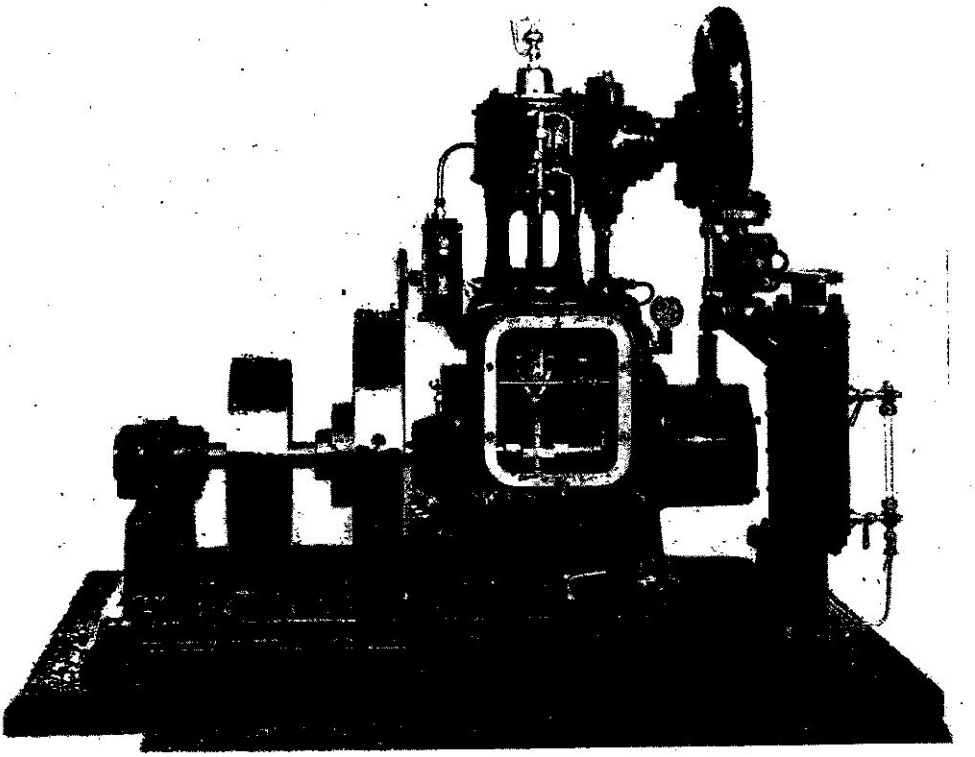


Photo by] [*Marshall and Co. (Nottingham) Ltd.*

Quarter-scale Vertical High-speed Steam Engine with main access door removed

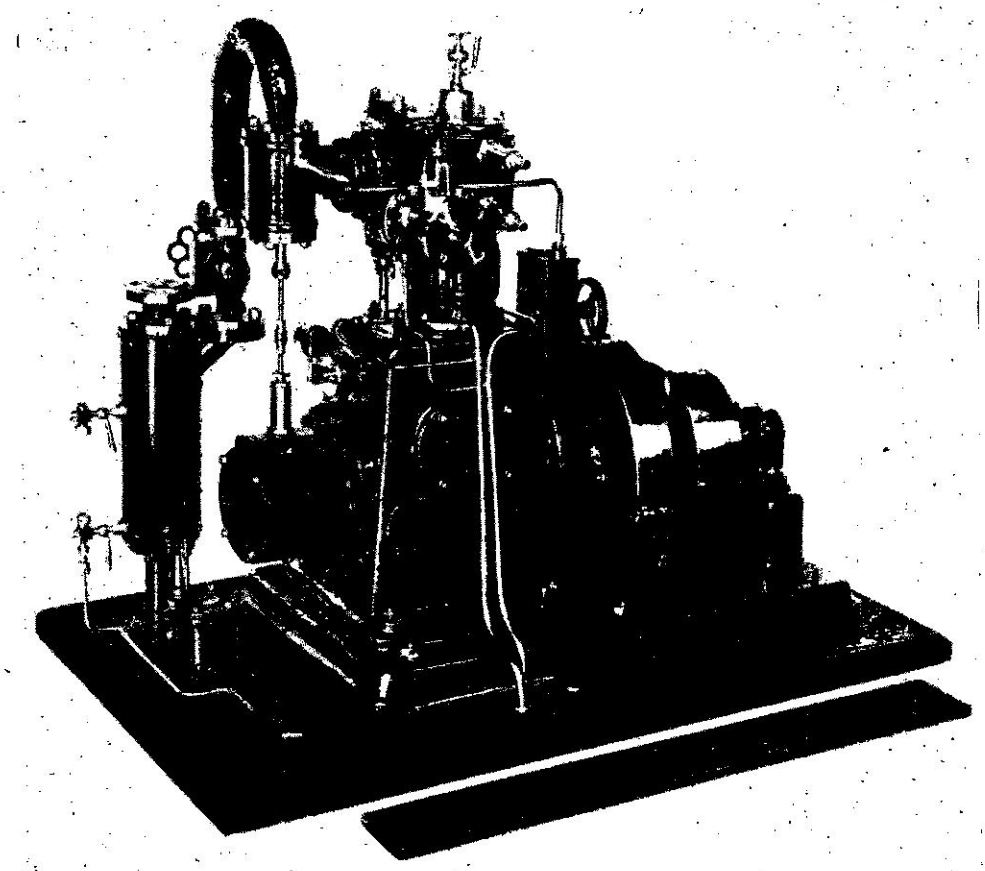


Photo by [*Marshall and Co. (Nottingham) Ltd.*

Rear view of the engine, showing steam separator, drain trap and waste water connecting pipes

is of fairly long standing, it being my privilege to represent the company to which I originally served my pupilage. I decided, some time ago, that an accurate scale working model of an actual production would convey more of the prototype's salient features to a prospective purchaser than would, say, a sectional arrangement drawing.

A Decision

After taking into consideration the question of weight and the machining capacity available, I decided on the smallest single-cylinder forced lubricated frame size; incidentally, this decision was not easy, as there are upwards of thirty frame sizes, covering from 1½ to 450 h.p., each with individual merit from the model-maker's point of view. A scale of 3 in. to 1 ft. was chosen as one enabling all the various components to be exact working duplicates. The materials for construction were principally brass plate, cast gunmetal and brass, and steel bar. It will be appreciated that on the prototype a considerable amount of cast iron is utilised for construction. Only two castings were used on the model, these being the main bearing facings and caps and the cylinder; all other components were built-up by either brazing or silver-soldering. The crankcase is built-up from 3/32 in. brass plate and all the actual ribs, etc. are correctly incorporated. Main bearing members, access doors and cover pads were silver-soldered at one heating, the fabrication then being machined as would be a casting.

Crankshaft Machining

The crankshaft is machined from solid mild-steel bar, quadrants being left at either end for turning the crankpin and eccentric sheave. These quadrants were, of course, later removed when finishing the shaft. On the prototype, the eccentric sheave is keyed on the shaft; but, due to its small size on the model, it was more convenient to machine it integral. All journals were finished with a lead lap and oilways drilled for lubrication system.

The main bearings and connecting-rod brasses are of the gunmetal shell, white-metal lined, split type, and are grooved for lubrication.

The combined crosshead slide and crankcase stuffing box assembly is fabricated, and, apart from generating the correct contour of the outside profile, no machining difficulties were involved.

The crosshead is of the marine slipper type, fitted with split phosphor-bronze brasses. The connecting-rod is of "Y" form and machined from the solid, an oil passage being drilled up one arm of the fork making connection with that in the crosshead pin, which, incidentally, is hardened and shrunk into position.

No Loose Connections

A minimum of piping is incorporated in the lubrication system and there are no loose or moving connections, all journals being under pressure. Oil from the pump is fed into the main pipe-line through the medium of a pressure release and oil regulator, and thence to the two main bearing caps; all other oil passages were drilled. From the long main bearing connection oil is fed to the connecting-rod pin and brasses, and from the short bearing to the eccentric strap, eccentric strap joint and governor gear. This oil passage converges at a central point in the connecting-rod pin, to boost the pressure to the piston-rod line of parts. These are supplied *via* the connecting-rod, oil being directed up the drilled hole in the fork to the crosshead pin and brasses, and thence to the face of the slide.

The Oil Pump

The oil pump is of the valveless, semi-rotary plunger type, and the motion for the drive is taken from the bottom of the eccentric strap. Oil is drawn by the pump through duplicate strainers situated in an oil box on the front of the crankcase, the strainers being removable for cleaning purposes while the engine is running. This is arranged by having each strainer con-

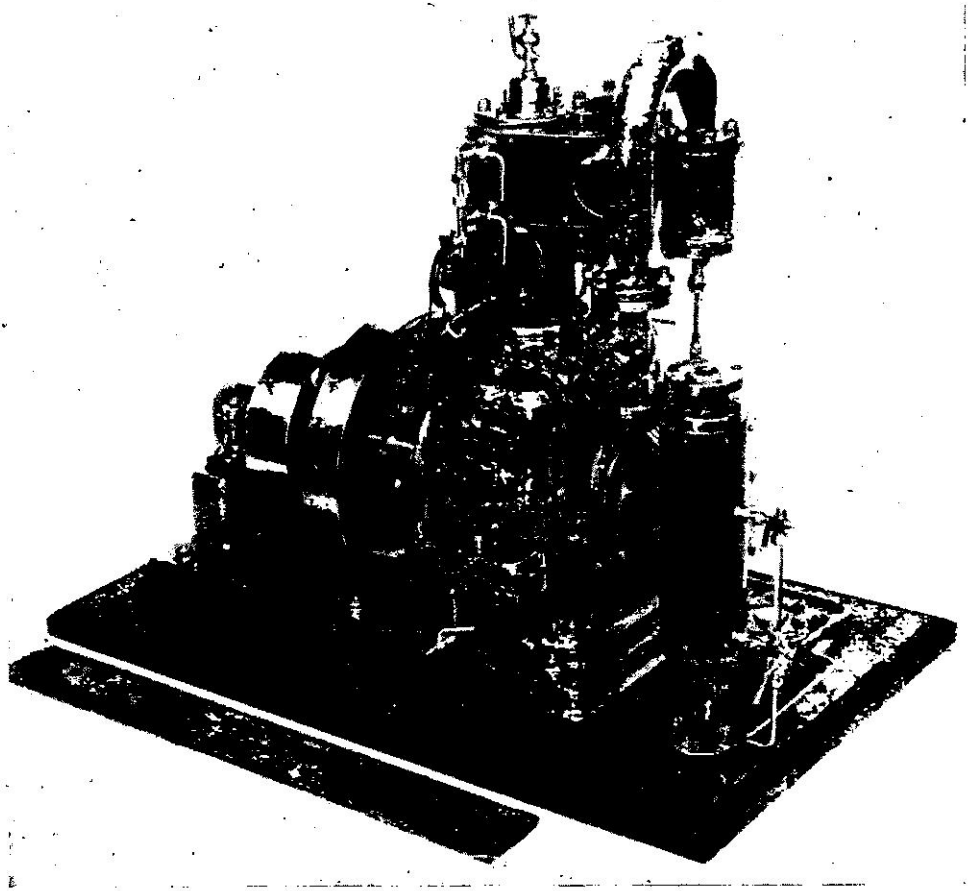


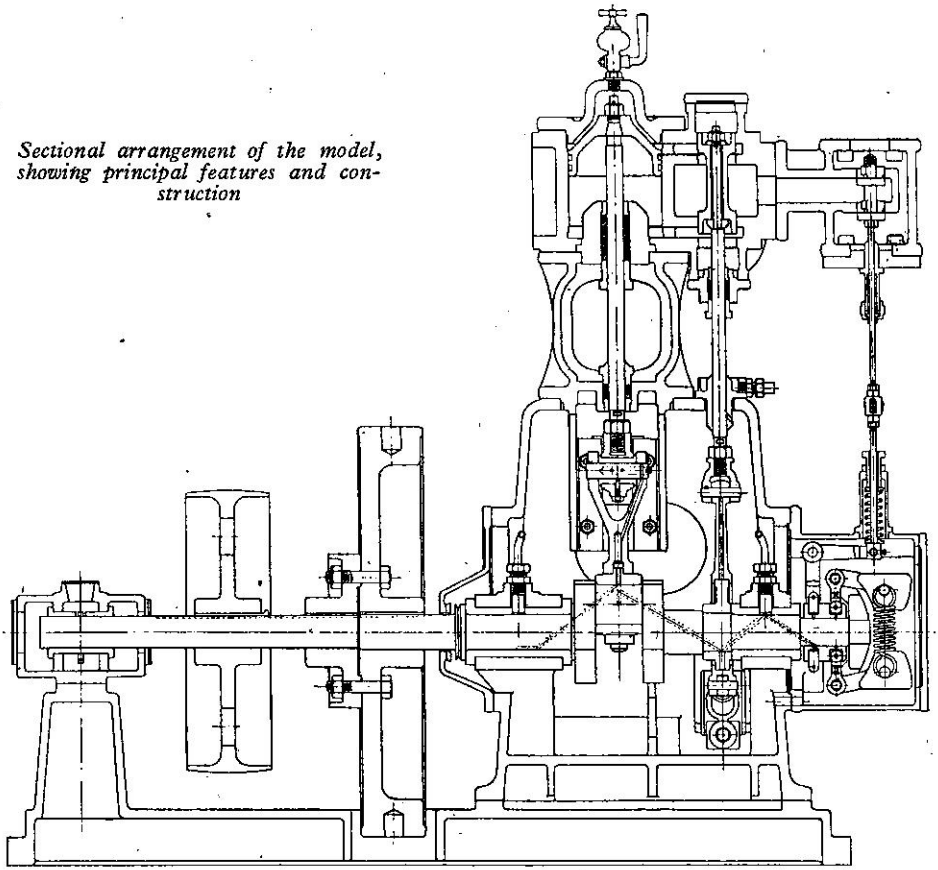
Photo by] [*Marshall and Co. (Nottingham) Ltd.*

Three-quarter view of the model; the oil-strainer box with oil-level gauge and draw-off cock will be noticed in the foreground

nected by a valve which automatically closes when a strainer is removed, thus preventing unfiltered oil entering the system. In operation one strainer is sufficient to maintain the oil supply to the engine. The pressure developed by this small pump at quite moderate speeds is surprising, there being no difficulty in maintaining 14 lb. per square inch in the system when running at 650 r.p.m. An automatic pressure release is incorporated in the distribution pipe, set for approximately 10 lb., excess oil being returned to the crankcase.

The governor is of the crankshaft throttle type with balanced control valve. The weights and head are of steel and machined from the solid ; the rollers and sleeve are hardened and all spindles are of silver-steel working in phosphor-bronze bushes, the working parts being forced lubricated from the system.

Sectional arrangement of the model, showing principal features and construction



The Fabricated Housing

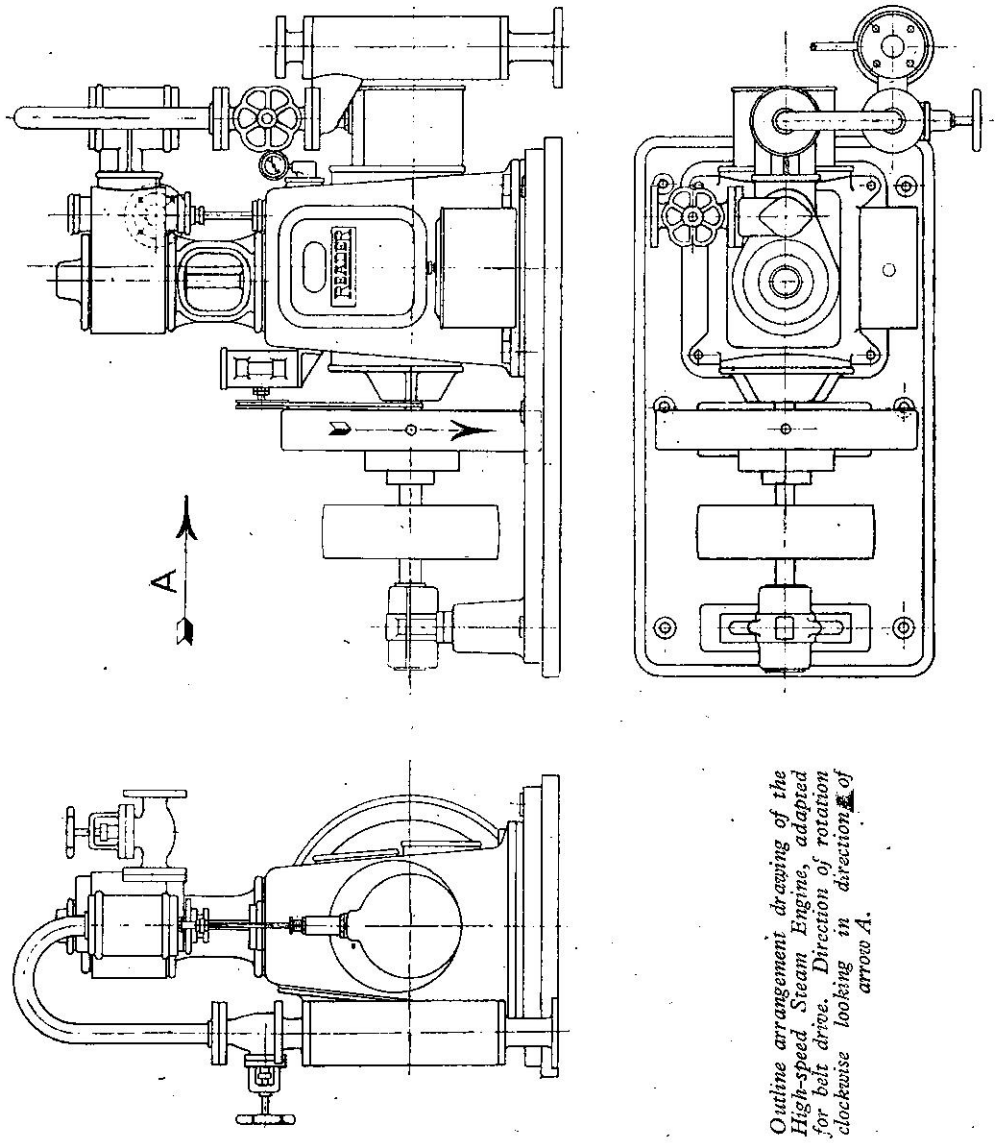
The housing incorporating the rotating parts is fabricated by means of silver-solder, as is the governor valve and box. Although built to a comparative small scale, the governor proved to be very sensitive in operation and maintains a steady speed of 650 r.p.m., the variation from full load to no load being small, approximately 5 per cent. It will be appreciated that the model, as with its prototype, is capable of considerably higher speeds, but as it is required for demonstration purposes, this was intentionally reduced to avoid the "blurred" effect usual when reciprocating parts are run at high speed.

The cylinder is a gunmetal casting, and, due to its comparatively small size, as well as its complicated steam and exhaust ports and passages, only the piston bore was cored. All other ports and valve bars were machined, and many setting-up and machining operations were required before success was finally achieved. However, the resultant unrestricted passageways were well worth the trouble involved.

The piston is of gunmetal and fitted with two "Ramsbottom" phosphor-bronze rings. The piston valve, which is self-aligning, is of phosphor-bronze.

Testing

The original intention was to run the model under steam, hence the choice of non-rusting materials for the cylinder gear. However, had this been the case, it was obvious that much of the paintwork and the lacquered, bright and



Outline arrangement drawing of the High-speed Steam Engine, adapted for belt drive. Direction of rotation clockwise looking in direction of arrow A.

gunmetal fittings would be discoloured, and it was, therefore, decided to compromise by utilising compressed air as a medium for testing and running the engine.

All the prototype's fittings are faithfully reproduced, both internally and externally, and include asbestos-packed cylinder drain cocks, cylinder relief valves, valve-chest drain, oil level gauge and drain cock, etc. Steam and exhaust valves have packed glands and self-aligning heads. A steam separator is provided, complete with watergauge fittings and the necessary drain trap. As it was intended to make the model as comprehensive as possible, a mechanical cylinder lubricator is fitted.

The engine is mounted on a combined bedplate with extended shaft, pulley and ring lubricated outboard bearing, making a complete unit, the approximate overall dimensions being 14 in. long × 11½ in. high × 7½ in. wide.

The completed model has a very satisfactory appearance and was well worth the many months of spare time involved in its construction; for, although it may be just another steam engine, to me it is different, especially as the prototype's actual running features are faithfully reproduced in miniature.

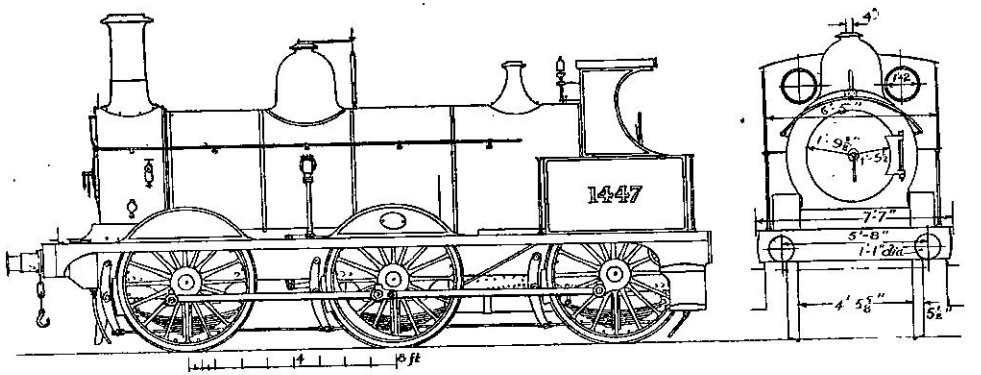
Locomotives Worth Modelling

By F. C. HAMBLETON

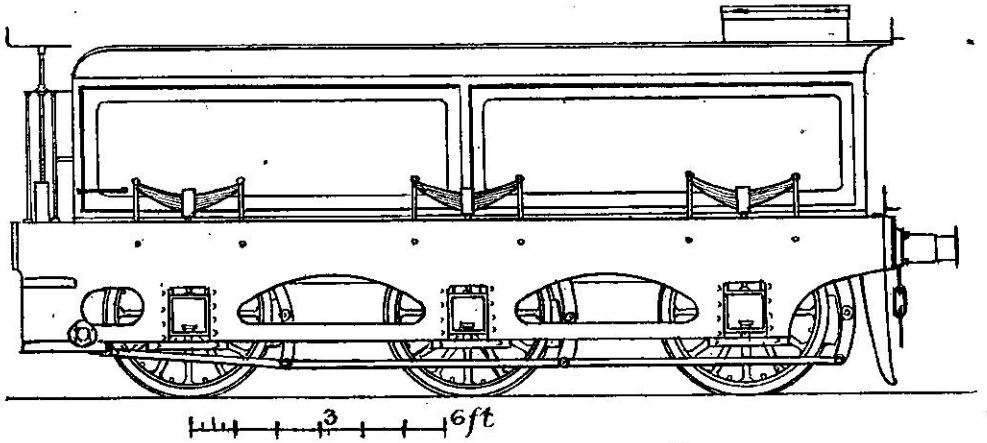
No. 10—Midland Railway. No. 1447

THE magic of the footplate! What a thrill it is to stand on that wonderful platform, no matter whether your engine is pounding along, or just resting quietly at a platform. Even clambering up into the cab in a shed creates the same feeling of excitement. Does it matter if there is no steam up? Not a whit! In fact, a locomotive when "dead" seems to possess an additional charm—so cold and massive, and yet with that lingering feeling of power and might. One peers through the driver's window, and thinks of the countless times the keen and experienced eyes have likewise gazed through that same pane of glass, intent on picking up a particular green spot of light in the murky distance. Yes, there's romance in cab windows, right enough. And history too! Glance at the three specimens on page 116, for example, The first of these magic circles belonged to the Stroudley goods engine, No. 418. A pleasant thing, this gleaming brass window-frame. It bore the characteristic stamp of refinement of Brighton design, and followed the old "weatherboard" tradition, by which I mean that it was a fixture, and not planned to open. The quarter-inch polished plate-glass disc was held between two such frames, the latter connected to each other, through the ⅛-in. thickness of the cab front sheet, by six ball-headed brass screws. Some of these fine old rings can still be seen in service on the Southern Railway, 75 years' work to their credit. Not so bad, eh?

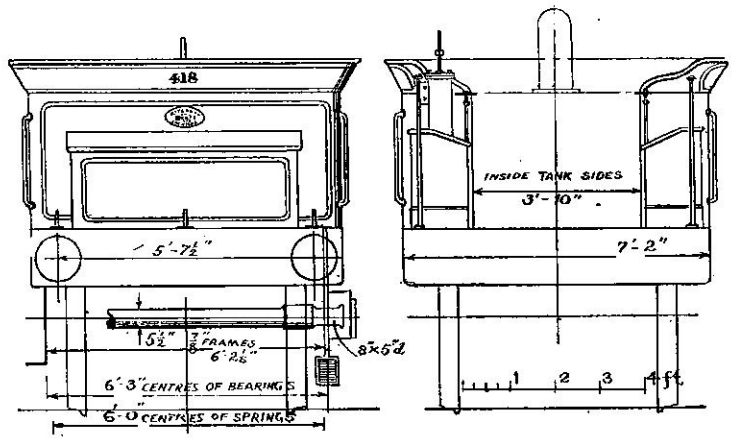
When Billinton migrated northwards, to Derby, we may be sure he examined Johnson's engines with more than a passing interest. Soon he was hard at it, as chief draughtsman, planning the second ancestor of "lovely 447," the Vulcan L.B.S.C. goods engine. In reality an up-to-date version of Johnson's Great Eastern Railway 0-6-0's, these fine locomotives, Nos. 1432 to 1471, were built in 1880-1, and had 5 ft. 2½-in. driving wheels, 17½ by 26-in. cylinders, and an excellent boiler with a heating surface of 1,313 square feet. They were distributed between Burton, Birmingham and Manchester. Did these newcomers differ very much from the Brighton "C" class, the details of which Billinton knew so intimately? Not a lot, perhaps. To be sure there was no feed-water heating gear on the Midland Railway, no crosshead pumps, or circular-section connecting-rods. But the Salter spring safety-valves were also mounted on the dome, although the valves themselves were of much simpler design than those of the L.B.S.C. Railway, and the dome-cover was a wonderfully large and ornate thing. It was beaten up out of copper sheet, and how splendid it would have looked had it been finished off bright! But, as it happened, it was painted green like the rest of the engine, and this grand chance of an imposing "eye-dazzler" was missed! Johnson was a cautious man, not putting his trust solely in those two 3½-in. valves on the dome top. Accordingly, another direct-loaded safety-valve was mounted on the firebox, and this was covered by an elegant and somewhat slender polished brass casing. Incidentally, as the years rolled by, the outline of these covers changed, owing to a diminution in height from 25 to 21 in., although not losing their grace. The Johnson cab was a very slight affair compared with the comfortable erection fitted to the Brighton engines, and consequently rather draughty. Its 14-in. win-



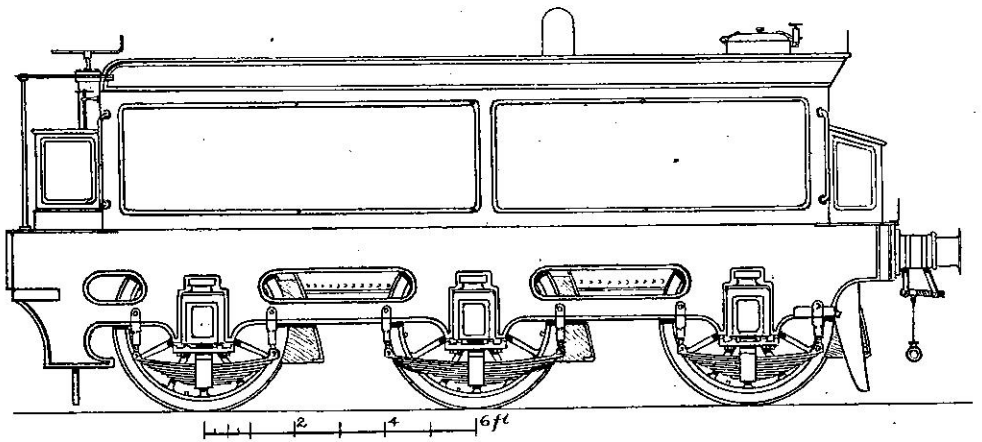
A fine example of a very numerous class of goods engines on the Midland Railway



Early standard M.R. tender as coupled to No. 1447



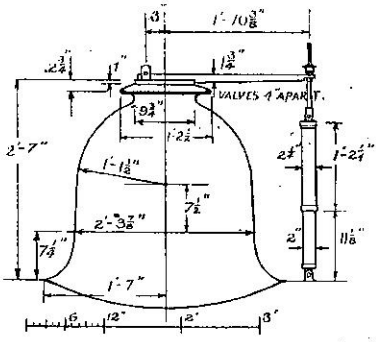
The early Stroudley tender as seen on end. Note the large exhaust steam dome which was painted red-lead colour



This tender, carried on six 4-ft. wheels, spaced equally at 6 ft., was as attractive as the engine to which it belonged

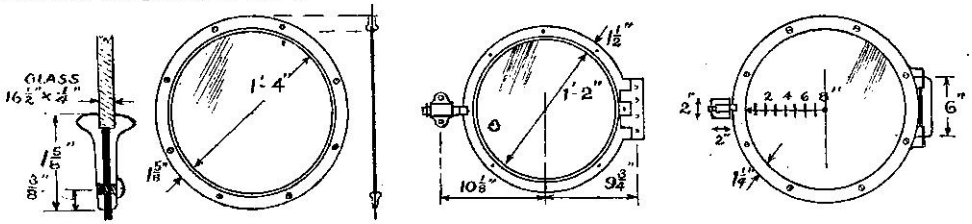
dows were fitted with a catch and hinges, and so opened inwards, whether for additional ventilation or for easy cleaning being a moot point. Both facilities appeared a little unnecessary, yet when Billinton returned once more to Brighton to take charge there after the lamented and untimely death of Stroudley, he took with him the Midland Railway design in general, increasing, however, the diameter of the glass to that of the Stroudley window, *i.e.*, 16 inches. The same could be said of some of the other details of "lovely 447," particularly the chimney, and the position of the sandboxes below the footplate. Now, although, perhaps, there were more "W.S." than "S.J." about Billinton's "Vulcan" goods, nevertheless the very prominence of the last two mentioned items gave the impression that No. 447 had inherited more of the good looks of the Derby family, rather than those of her Brighton relatives!

The tenders provided for the Brighton "C" class, and the Midland Railway 1447 type, well deserve a word or two, since the Derby design was so typical of the period, whilst the L.B.S.C. was so novel in many ways! The feature that struck one immediately of the latter was the underhung springs—a very rare arrangement—and, perhaps, the first example of such an arrangement. In accordance with Stroudley's unorthodox ideas of suspension, the centre springs had more flexibility, being no less than 4 ft. between centres, while the front and rear ones measured 3 ft. in length. The axleboxes were nice things with their rectangular projections. They were painted dark olive green ornamented with a simple black line (a colour scheme applied to the whole tender) and were surmounted by oil-boxes with a polished brass lid. To keep the feedwater hot the tender tank was lagged, the cleading plates extending the full width, 7 ft. 2 in., of the engine. Six rivets held the plating in place, with the centre



This dome was one of the most attractive features of the Midland engines

to the prevailing olive-green scheme. At the cab end two wooden boxes were provided, the left-hand one for odds and ends, the other functioning as a sandbox. The standard pattern of hand brake handle was fitted, as well as two brass handwheels, threaded through their bosses so as to actuate the feed-water cocks below the footplate. The tank held about 1,860 gallons of water, and was in the form (in plan) of a horseshoe with straight sides. At this early period Stroudley had not hit on the idea of arranging the coal-well above the footplate level, and consequently the men often rigged up a couple of cross-boards to prevent the coals making a premature journey and gathering, "friendly-like," around the fireman's ankles! But when, in 1875, a special tender was built for the famous single-wheeler *Grosvenor* to go to the Newark brake trials, the front plate and lifting coal door (illustrated previously in connection with "lovely 447") was devised, although the tender itself otherwise was merely an enlarged version



A study in windows! Stroudley on the left, Johnson in the middle, and their descendant, young Billinton, on the right

rivets placed vertically over the middle axle. This gave an unequal length to the two panels of black banding. The tool-box was at the rear, and as there was no side footplating, access to the tools could only be gained by clambering up the rather high single rear-footstep. The spring hangers were adjustable, the rear one passing through an opening in the step. Originally, the water-filler was just a simple "slam-down" lid of sheet-iron, but later on a heavy dome-shaped cast-iron lid, complete with screw-down catch, was substituted. This, together with the big exhaust-steam dome and the top-side of the tank, was painted that harmonious red-lead colour. This tint made a pleasing contrast of the type under notice. Henceforth, this useful labour-saving device became standard on all L.B.S.C. tenders. Oh! and we must not forget the little gilt numerals on the coping at the back. The top edge of the coping, as well as the junction of it along the top edge of the cleading plate, were bordered with a black line. Buffer-beam and sockets were red, picked out with black lines edged with fine white ones. A lovely tender, I think, which was the perfect companion to a beautiful engine. The Midland tender, with its short 30-in. springs, placed above the footplate was a typical specimen of the period, particularly the way the handbrake spindle was placed between the double vertical handrails.

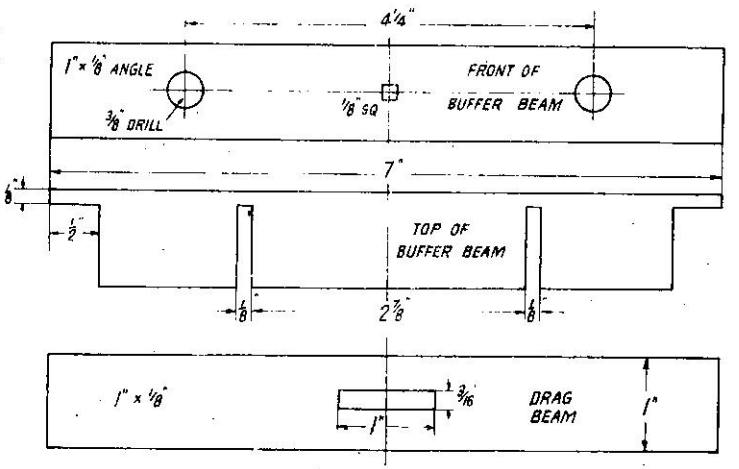
"Hielan' Lassie"

By "L.B.S.C."

A 3½-in. Gauge L.N.E.R. 4-6-2

IF the hornblocks are fitted to the main frames right away, there will be no need to go back on the job, in a manner of speaking, as the frames can be erected "for keeps" when the buffer beam and trailing cradle are all ready. It will be seen from the illustrations, that the hornblocks are of the regulation L.N.E.R. pattern, and castings should be ready for delivery by the time these notes appear in print. The plain side, which fits next to frame, is milled exactly as described for "Petrolea," the casting being fixed to a vertical slide on the lathe, and traversed across an end-mill held in the three-jaw; or it may be done, of course, on a regular milling-machine, if same is available. In the absence of the necessary appliances, it isn't a difficult job to clean up the contact-face with a file, and fit the hornblocks to the slots in the frame; I did quite a lot that way, in days gone by. Anyhow, after fitting to the frame slot, put a toolmaker's cramp over frame and hornblock, drill any two of the No. 40 holes shown, clean through hornblock and frame; countersink them on the outside of frame, and put in a couple of 3/32 in. round-head charcoal-iron rivets; remove clamp, drill and countersink the rest of the holes, and rivet up. File off all the rivets flush on the outside of the frames, and then file the bottoms of the feet or lugs flush with the bottom of the frame. Next, temporarily clamp the frames together inside out, as the kiddies would say, the hornblocks being on the outside; and be very careful that they are exactly in alignment. The jaws of the hornblocks can then be milled or filed out in pairs, so that the axleboxes will fit correctly, and the axles will lie exactly square across the frame. I have seen quite a number of locomotives with the axles looking as though somebody of the calibre of Fatty Hermann had been using them for a step-ladder. Speaking of that unworthy, I wouldn't mind risking a bet that he now wishes he had concentrated all his attention on his own small railway, and let other folks' big ones alone; he might even have brought a little Borsig or Henschel 4-6-2 over, for a friendly run on some club or exhibition track, instead of which—well, there's no accounting for some people's tastes!

"Hielan' Lassie's" frames are a bit too long to mount up on the average small lathe, for milling the hornblock jaws either by flycutter or end-mill; so, unless a regular milling-machine is available, a spot of careful filing will be called for. It isn't a difficult or tedious job; it merely requires care, a big second-cut flat file, and a "straight eye." Grip the frames in the bench vice, with the hornblocks in the middle of the jaws, then carefully file the latter evenly at each side, until a piece of ⅞-in. bar about ½ in. wide, will fit between them easily without shake. That is all there is to it! The hornstays are 1⅞-in. lengths of ⅜-in. by 3/32-in. mild-steel, drilled as shown; the screw-holes at the ends are slightly off the centre line, to bring the screws right in the middle of the hornblock feet when the hornstays are attached. No need to fit them until the axleboxes are ready.



Buffer and drag beams

Buffer Beam

This may be either a casting, or a 7-in. length of 1-in. by ⅛-in. brass or steel angle, steel for preference. Last time I saw Dick Simmonds, he said he would be making cast beams for all "live steamers," with lugs integral, for attachment of frames; if so, all the attention needed

would be smoothing off with a file, slotting for frame-plates, and drilling and tapping for screws. A beam made from angle is first slotted for the frames, as described fully in the "Petrolea" serial. I might here mention, for information of beginners who are new readers, that every machining, fitting, and kindred operation needed in the construction of a little locomotive, was fully detailed out, for beginners' special benefit, in the serial referred to; and it would be advisable for them to acquire the back numbers and read up the processes. They all apply equally well to the present engine, and it would be hardly fair to our more experienced readers who are waiting to get on with the "Lassie," to keep them waiting whilst the whole rigmarole is gone through again. I propose only to go into full details where the difference warrants it.

The slotted beam may be attached to the frames either by angles, or by brazing or Sifbronzing. In the former case, a piece of ¾-in. by ⅛-in. angle is riveted to the back of the beam, level with the inner edge of each slot; see plan view. The frames are then driven into the slots, and the assembly thus far constituted, laid on its back on the lathe bed. The frame tops should be in contact with the bed for the full length of the raised part over the coupled wheels. The beam should be square with them, and each end the same height from the lathe bed. Put a toolmaker's cramp over frame and angle, run the No. 30 drill through holes in frame, make countersinks on the angle, follow up with No. 40 drill, tap ⅛ in. or 5 B.A., and put in the screws, as shown in the illustration.

For brazing or Sifbronzing, you need a couple of metal or hardwood blocks, 2⅞ in. wide, to place between the frames, and a couple of big clamps to go over the lot, and hold the frames parallel. The buffer beam, which will need no angles, is then placed in position, and adjusted so that it is square and level. The whole issue is up-ended in the brazing pan or forge, and the frames brazed or Sifbronzed to the beam, at the points where they enter the slots. I worked this wheeze on the frames of my 3½-in. gauge L.N.W.R. "Jeanie Deans," thereby literally "pulling a fast one" on the late "Bro. Francis of Crewe," for the job was done in far less time than by the riveted-angle method he specified for the Crewe product. I used a 150-litre tip in my No. 2 "Alda" blowpipe, No. 1 grade Sifbronze, and the special flux for use with same. It was merely the work of a few minutes to run a lovely neat fillet each side of the slots and the joints between ends of frames and the beam. I used my drill-blocks for distance-pieces between frames, as they happened to be just the right width. Note for beginners: remember that you never have to put a "steel" job in acid pickle after brazing; quench out in water only.

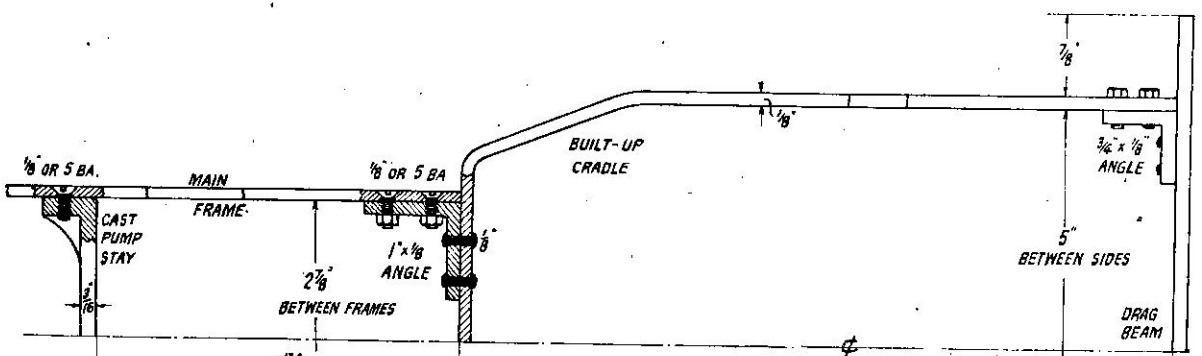
Trailing Frame or Cradle

The complete trailing frame assembly may be built-up from separate castings, or be a one-piece casting, or "fabricated," just as you please. My "Bantam Cock" had a similar but shorter cradle; Dick Simmonds supplied a set of castings for it, consisting of two sides with dummy springs and horncheeks integral, and a front member with lugs on it for attaching the main frames. Mr. Haselgrove cast the whole issue in one piece, including the drag-beam; but this needed separate springs and horncheeks, owing to moulding difficulties, so there wasn't much in the way of advantage either way as regards actual work involved in machining and erection. However, the castings saved a vast amount of time and labour over the fabrication method; and as our friends are obliging again for the trailing end of "Lassie," builders with limited spare time should use them.

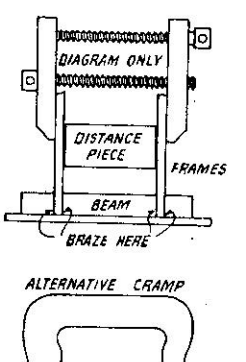
The illustrations show the methods of erection, and very little explanation is called for. Any roughness in the castings should, of course, be smoothed off with a file, and the lugs all truly faced. In the separate four-piece assembly, the side frames are first screwed or riveted to the front portion, taking care to have the two frames parallel; then the drag-beam may be attached. This is cut from a piece of 1-in. by ⅛-in. flat mild-steel, slotted as shown for the drawbar, and is screwed to the two lugs provided on the back end of each casting. The main frames are then screwed to the two lugs projecting from the front part of the cross-beam; take care to keep the main frames parallel. The easiest way is to lay the frames upside down on the lathe bed again, fit the cradle to them, and temporarily clip the main frames to the lugs on the cradle, by a couple of toolmakers' cramps, whilst adjusting the cradle so that the drag beam is square with the main frames, and the same height each end from the lathe bed. Put a couple of screws in each side, remove cramps, and then put in the rest of the screws. If the lugs should be on the thin side, use lock-nuts as well. The one-piece casting is erected same way. Don't bother about the horn-slots yet; the trailing axle is of the radial pattern, and if all goes well I shall be devoting a special "chapter" to making and erecting the parts.

For a "fabricated" cradle you will need a piece of ⅛-in. mild-steel, 3 in. wide and 18¾ in. long. Square off the ends, then mark off, and saw and file both ends to outline and dimensions given in the general arrangement drawing, reproduced last week. The piece is then bent to the shape shown; if the steel is mild and ductile, it shouldn't require a great deal of "Sunny Jim" to get it to the required shape. Builders who fancy their skill at carpentry, might do worse than to plane up a block of hardwood, and use it for a former on which to bend the steel; but don't forget to make the block to the *inside* dimensions of the cradle, allowing for thickness of material. Beginners, if they slip up here, will find one side comes out longer than the other; and if bending without a former, may get the same result through not marking off correctly the points at which to make the bends; so watch your step!

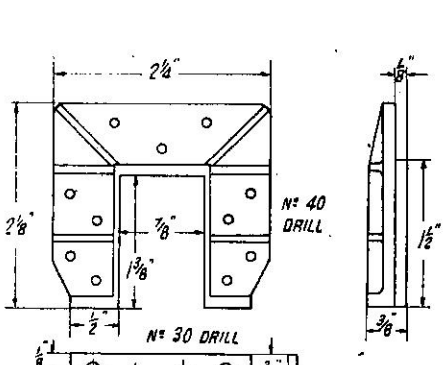
The plan of the fabricated cradle shows how it is assembled. The drag-beam is as mentioned above, a piece of 1-in. by ⅛-in. steel, 7 in. long, and is attached to the sides of the cradle by screws and angles. Pieces of 1-in. by ⅛-in. angle are also riveted to the front part, for attaching the main frames as shown; these must be



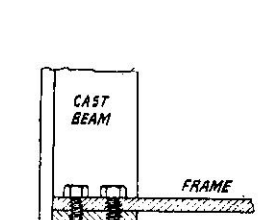
Trailing end with built-up cradle



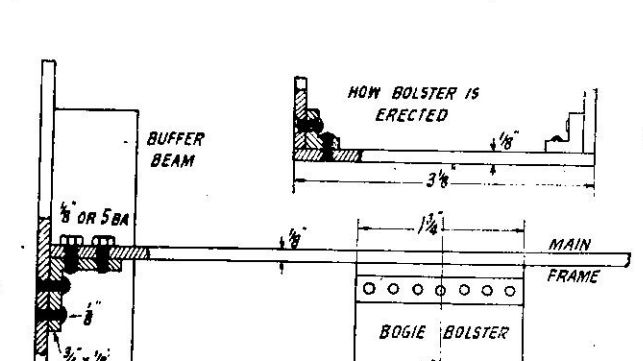
How to set up for brazing beam to frames



Hornblock for coupled axles

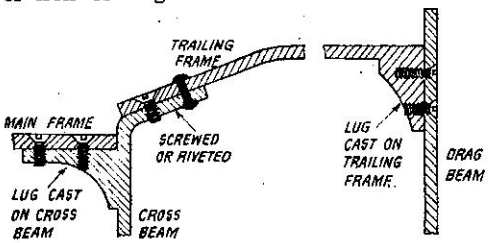


Alternative cast buffer-beam



Leading end with plate bolster

2⅞ in. apart. Use ⅛-in. charcoal-iron rivets, and locknut the screws. Alternatively, anybody who has brazed or Sifbronzed the main frames to the buffer beam, can "ditto repeato" this end; only, as you have no slots to fit the ends of the frames into, you'll have to be careful about location. The way I do it, is to lay the drag-beam in the coke in the brazing pan, making a little bed for it so that it is quite level, and cannot shift; then the cradle is stood end-up on it, and adjusted so that the sides are equidistant from the ends of the beam. To prevent it shifting, I just put a bit of iron bar, or a fire-brick, or anything else handy, with one end resting on the cradle and the other on the back of the pan, which is high enough to support it. Then a smear of flux at each side of the frames, a gentle application of the Alda, followed by a touch with the Sifbronze rod as soon as the metal reaches bright red—and hey presto! it's done, and a lot easier than soft soldering, at that. To attach the main frames to the cradle, I should put the distance-piece mentioned above between the frames near the rear end, and a cramp on the outside; then the cradle can be set in position against the ends of the frames, and a few strands of iron binding-wire wound around the front



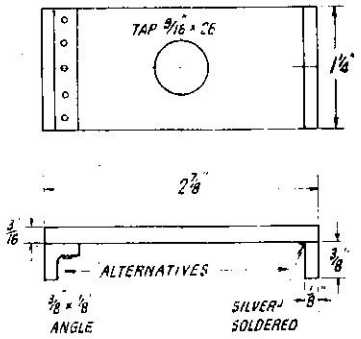
Cast cradle assembly

of the cradle and the distance-piece, to keep cradle and frames in contact. The actual Sifbronzing is then done exactly as above, leaving a fillet on each side of the ends of the frame where they are in contact with the front part of the cradle. A frame thus assembled, and set truly before receiving attention with the blowpipe, would never warp, twist, come apart, or suffer any other untoward happening during the lifetime of the locomotive, even if designated "Methuselina" instead of "Hielan' Lassie."

Bogie Bolster

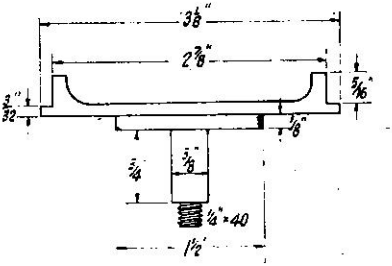
No special staying will be required for the frames, as the bogie bolster and the support for the feed pump will do all that is required. The bolster can either be cast or built up. If cast, it will have a chucking-piece on the same side as the flanges, and the bogie pin cast integral. Chuck by the piece provided, in the three-jaw, and turn the bogie pin; then face off the circular boss which bears on the bogie centre casting. The rebates where the frames rest, can be milled, either on a regular machine, or in the lathe, by clamping either under the tool-holder or to a vertical slide, and traversing across an end-mill held in the three-jaw, as described for "Petrolea's" axleboxes. The machined casting is then placed between the frames and secured by screws put through the holes already drilled between the openings for the bogie wheels, into tapped holes in the flanges; the distance from front of frame to centre of bogie-pin being 4 3/32 in.

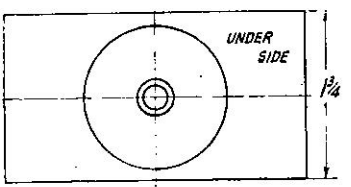
For a built-up bolster, cut a rectangular piece of ⅛-in. steel plate, 1¾ in. wide and 3⅛ in. long, At ⅛ in. from each of the short sides, rivet a piece of ⅜-in. by ⅛-in. angle brass, and file the ends off flush. Drill a $\frac{5}{16}$-in. hole in the middle, then insert the piece between the frames, with



Pump stay

the centre of the hole at 4 3/32 in. from the front end of the frames, back of the vertical part of the buffer beam. Secure as above, with countersunk screws running into tapped holes in the angles, as shown in the small detail illustration. The bogie-pin for this bolster is made from ⅜-in. round steel, and attached by a nut, the end being shouldered down and screwed, to pass through the hole; see coming illustrations of the complete bogie assembly.





Cast bogie bolster

Pump Stay

This also may be a casting, or built up. If the former, the ends will need machining up, to fit between the frames. Milling is, of course, the easiest way, but if no machine is available,

(*Continued on page* 123)

*IGNITION EQUIPMENT

By EDGAR T. WESTBURY

A comprehensive review of the working principles, design and construction of electrical ignition apparatus employed on all types of internal combustion engines

Part II—Design and Construction (*Continued*)

I HAVE not considered it necessary to give detailed drawings or instructions for building the "Atomax" series of magnetos, as they are highly adaptable, and can be modified in detail to suit the individual requirements of constructors, without affecting their basic working principles or impairing their efficiency. It is only necessary to observe fundamental rules of design, which I have emphasised many times in these articles, to ensure successful results, and the working margin of this type of machine is sufficiently wide to tolerate minor errors, which might be very detrimental, or even fatal, in a magneto in which everything is cut down to the minimum in size and weight. I have proved that the "Atomax" magnetos will work effectively, even when the magnet has been partially demagnetised by ageing or rough usage; the air gap between the rotor and stator poles is not at all critical, and slight differences of angular length and overlap of the poles are also permissible. It should be observed that the angular range of advance and retard, over which an efficient spark can be obtained, is only half as wide in a four-pole magneto as in a two-pole magneto; but this is of very little practical importance, as the range is still wide enough for the requirements of all the engines on which it has yet been tried. As a matter of fact, when once the setting of the ignition which produces the best engine power has been found, a very small range of timing adjustment will suffice in most cases, except where the utmost flexibility of engine control is desired. Fixed ignition setting has been used quite successfully on some small engines. But optimum spark efficiency "all round the clock" can be obtained by mounting the magneto stator and the contact-breaker on a single back-plate, adjustable around the rotor bearing for timing purposes.

*Continued from page 72, "M.E.," January 17, 1946.

Timing

In case constructors find any difficulty in timing the contact-breaker relative to the rotor poles in this type of magneto, it should be made clear that the principle is exactly the same as in the two-pole magneto, but that the flux distortion angle is halved. That is to say, the break should take place when one of the rotor poles has passed the "neutral" position by about fifteen degrees; the neutral position is when the rotor pole just bridges the stator poles, with equal overlap each side. Individual magnetos may vary slightly, so the best position should be found by trial if the utmost spark efficiency is required; but I have found this setting near enough for all practical purposes.

It is quite practicable to arrange a magneto of this type to spark equally well when running in either direction, by adjusting the "dwell" of the contact-breaker cam, so that the break takes place at the correct place both ways. This feature is of dubious merit for engines of normal type, in which rotation is unidirectional; but it may be useful in certain cases to have an engine which is capable of running both ways. Instances have, however, occurred where an engine has inadvertently been started in the wrong direction, with disastrous results; and magnetos on full-sized engines are nearly always designed so as to be incapable of sparking in the reverse direction without special alteration—usually involving the fitting of a different contact-breaker. Incidentally, the only form of internal combustion engine which can be run equally efficiently in either direction without alteration, is the simple port-admission two-stroke with

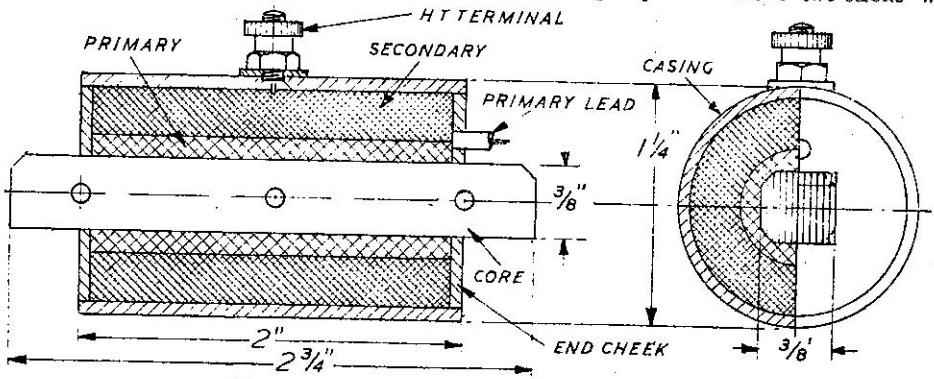


Fig. 70. Coil for "Atomax" type magnetos

symmetrically located (i.e., not desaxé) cylinder. Cases have been known of four-stroke engines running more or less consistently for a few seconds in the wrong direction; exactly how this can happen is somewhat of a mystery. A certain type of aircraft engine, in the good old days of prop.-swinging, acquired a sinister reputation as a man-killer through its proclivity for starting up and running a few revolutions backwards.

Coil for "Atomax" Magnetos

As the voltage normally produced by this type of magneto is higher than that of the "Atomag Minor," it is most essential that the coil should be carefully wound and well insulated; but here again, it is a relatively easy job, as the amount of space allowed for the windings is much greater. The type of coil which has been used, with certain experimental variations, for all the magnetos in this series so far constructed, is one having a casing diameter of 1¼ in., and a length of 2 in. less core projections. Anyone who has acquired a certain amount of practice in coil winding by producing one of the miniature ignition coils described earlier in this series, should be able to tackle this coil with confidence.

The specification for the coil, which is illustrated in Fig. 70, is as follows: *Core*: built up from strips of 20-gauge soft iron, ⅜ in. square by 2¾ in. long, riveted firmly together, and corners rounded off in the centre for a length of 1⅞ in. *Primary*: three layers of No. 22-gauge enamel-covered wire, approximately 150 to 180 turns; one end earthed by soldering to the core, and the other led out through end cheek, as described for the "Atomag Minor" coil. *Secondary*: 15,000 turns of No. 44 gauge wire, interleaved with paper 2 mm. total thickness between each layer. Inner end connected to primary lead-out, and outer end to h.t. terminal. *Casing*: Paxolin tube, 1¼ in. o.d. by 1/16 in. thick, with end cheeks of same thickness, having squared holes in centre to fit over projecting ends of core.

The technique in winding and assembling the coil is exactly as explained in earlier descriptions. Oil varnish impregnation of the windings is recommended for maximum durability, but wax impregnation is reasonably satisfactory if the casing can be hermetically sealed, and provided that it does not become too warm in use.

As in all other vital factors in the design of this series of magnetos, I have, so far as possible, allowed a wide margin in the efficiency of the coil, so that it will give reasonably good results under the most adverse results. The coil at present fitted to my demonstration model of the "Atomax II" is one which had what was intended to be a destruction test, by running it on open circuit for a total period of 100 hours. Although there has been some falling off of its efficiency, indicating a certain insulation leakage, it still produces ¼ in. sparks quite easily.

A Disappointed Reader

In a recent letter from a correspondent, I am taken to task for my frequent use of the word "research" in referring to the development of miniature ignition coils and magnetos. My correspondent is disappointed to find that, after making such a song and dance about "research," all that I have to show in the way of results are devices which work on old-established principles, and embody neither any brilliant new ideas nor daring departures from current practice. My claims to have conducted research work are therefore, he concludes, null and void.

Well, it would appear that the only point in dispute is the definition of the word "research." I have never claimed to be a brilliant theorist, or to have made any attempt to turn established principles upside down, but I have carried out a good deal of original work in the investigation into, and development of, ignition equipment for small engines, and am still doing so. Please correct me if I am wrong, but I believe that the term "research" covers all the detail work involved in the practical development of an idea, and is more truly applicable to work of this nature than to initial "invention" or discovery of a new principle as commonly understood, though it is by no means quite clear where one begins and the other ends. If one takes the literal meaning of the term, it implies "repeated investigation," which is undoubtedly correct in practice, if my own experience is anything to go by.

In many branches of engineering, working principles are exactly the same as they have been for at least the last fifty years. Electric dynamos, motors and transformers still follow the principles expounded by Faraday; the internal combustion engine still works in the same way as it did in the days of Otto and Dugald Clerk; and the lathe and other machine tools have never departed from the precepts of Maudslay and Whitworth. Would my correspondent consider that the hundreds of engineers who have contributed to the development of design in these and other fields of practical engineering, have no claim to the title of research workers?

Many things are absurdly simple once they have been explained, and that applies to most of the devices which I have described in these articles. Take the "Atomag Minor," which is nothing more or less than a small size "copy" of a standard rotary-magnet magneto, if one considers it purely on face value. It may be very difficult to understand why it should take me years of hard work to arrive at the result thus obtained. No doubt much of the investigation into basic principles of design which my colleagues and I carried out, and for which we built an enormous amount of experimental equipment, had been done before by firms engaged in the manufacture of ignition appliances; but the objects in view were not quite identical, and moreover, such knowledge of these appliances as commercial firms have obtained for their own use, has not, so far as I can ascertain, ever been made available to the public. A good deal of the work which has been described in these articles has been done with the object not only of producing something which would work, but also of finding out *why* some things work

and others do not, for the purpose of forming a sound basis for the design of devices which may be orthodox in principle, but are certainly new, or at least out of the common, in practical development. I believe this to be true research work; what do you think?

Trade Developments

Apart from the many amateur constructors who have been able to produce successful ignition equipment with the aid of information contained in these articles, many professional readers have also found them useful in providing data for manufacturing purposes. I happen to know that many electrical and model supply firms have very carefully filed the specifications for ignition coils and magnetos which have appeared in these pages, and are making use of them, with or without modifications or improvements of their own, in the production of new lines, which are undoubtedly in great demand at the present time. This is quite in order, so far as I am concerned, and I am very glad to be able to be of assistance to the trade, and even more so to the users who have been waiting so long for these products.

But there is a word of caution which I would like to put to readers in connection with this matter. I have already pointed out that in the production of a successful ignition coil or magneto, the technique is at least as important as the formula, and even though the materials, quantities, and dimensions laid down in my articles may be correctly adhered to, this does not give a 100 per cent. guarantee that the article is satisfactory. There is also just a possibility that an unscrupulous trader, taking advantage of the fact that one cannot check up the internal construction of an ignition coil without destroying it, may foist inferior products on buyers under the guise of an article following THE MODEL ENGINEER specifications.

I have examined samples of some of the ignition coils which have been advertised recently in THE MODEL ENGINEER, and find that some of them are apparently correct in their essential features, and up to the standard of performance which I consider necessary for efficient ignition. Others are not so hot, and in one or two cases they are so inefficient as to be practically useless.

It is my intention to safeguard the interests of readers of THE MODEL ENGINEER in these matters, but obviously it would be most indiscreet of me to make any public statement about products which I consider unsatisfactory, or to make odious comparisons between the products of various makers. Any attempt in this direction might possibly cause me to run foul of the law of libel. But what I can do is to give readers advice which may help them to pick out the sheep from the goats. I do not propose issuing any kind of a "black list," even for strictly private circulation, but if any reader is offered products of this nature, either purporting to be of my design, or otherwise, of which he has the least doubt as to their quality, I shall be glad to advise him as to whether I can personally recommend them. In cases where I have inspected and tested sample products, I cannot guarantee that every one of the products will come up to the same standard, but the satisfactory result of a sample test does at least prove that the maker is capable of producing a sound job.

One or two manufacturers of small ignition coils, and also retail dealers in model supplies, have approached me on the matter of devising safeguards against dubious practices in the supply of these goods, and I suggest that a simple test instrument, with a fixed "minimum" spark gap of not less than 5 mm., and a voltmeter and ammeter to show primary input, should be used for a routine test of every coil sold. In this way, the customer could satisfy himself that the coil is at least in good working order, in the same way as can be done when buying an electric lamp or battery; and while this does not apply to mail order business, the announcement that such a routine test is rigidly observed would do much to confirm the customer's confidence in the reliability of the product.

(*To be continued*)

"Hielan' Lassie"

(*Continued from page* 120)

the casting can be clamped under the slide-rest tool-holder and traversed across an end-mill in the three-jaw. A big end-mill will be needed, not less than $\frac{5}{8}$ in. diameter. The ends could also be trued up on a planing- or shaping-machine, simply clamping the stay in the machine vice, and operating with a round-nose tool in the clapper box, taking a good cut with a fine feed. In the absence of any machining facilities, that hard-worked tool, the hand file, can be pressed into service, using the tops of the vice-jaws as a filing guide; just mark off how much the casting has to be reduced, to bring it to correct width, place in vice so that the marked line is level with tops of jaws, and exercise your muscles, keeping the file horizontal. Check with a try-square when through. The stay is attached to the main frame by three $\frac{1}{8}$-in. or 5 B.A. countersunk screws at each side, as shown in the plan sketch, the back of the stay being $3\frac{13}{16}$ in. from the front of the cradle.

A built-up stay is made by cutting a piece of $\frac{1}{8}$-in. or $\frac{3}{16}$-in. brass plate, to a length of $2\frac{7}{8}$ in., and a width of $1\frac{1}{4}$ in. Two pieces of $\frac{3}{8}$-in. by $\frac{1}{8}$-in. brass angle are riveted to the short ends, flush with same; or alternatively, a piece of $\frac{3}{8}$-in. by $\frac{1}{8}$-in. flat brass rod could be silver-soldered on at each end, flush as before, to take the fixing-screws. Drill a $\frac{1}{2}$-in. hole in the middle, and tap it $\frac{9}{16}$-in. by 26 for the pump barrel—this applies also to the casting mentioned above, if same has no corehole in it—then erect in frames as given above for the casting. The centre of the hole should be exactly $\frac{3}{4}$ in. above the bottom line of the frames, so that the pump barrel will be level with the centre of the driving axle when the axleboxes are in their correct running position.

*A CONGREVE CLOCK

By Dr. J. BRADBURY WINTER

Details, dimensions and instructions for making an attractive timepiece

THE rocking-lever is now to be tackled. Details are shown in Fig. 10. The lever and boss are all in one, cut from half-inch black square mild-steel. Start by bending it to shape when red-hot; a blacksmith would do it in a few minutes if you are unable to heat it properly. A full-size drawing should be made, and the forging laid on it to see that it covers. Leave the ends too long, a couple of inches beyond the boss, and sufficient beyond the slot to serve as a handle.

Next, file flat the surface away from the boss. It is easy to make a mistake here, finding later on that you have got the boss on the wrong side. In the view which shows the slot, note that the boss is dotted, meaning that it lies away from you, and the surface facing you is the one to be filed straight and flat. The extra length at the slot end can be sawn off, but the two inches above the boss must be retained and included in the flattening.

The shape of the lever is not just a matter of artistic appearance; there are very small clearances inside the plummer-block, not much to spare where it crosses one of the four main pillars, and the slot must be part of a circle struck from the centre of the crankshaft.

Make a centre-pop to mark the centre of the boss on the non-flattened surface, and describe a circle to indicate the boss $\frac{7}{16}$ in. diameter. Saw down the whole length, both above and below the boss, leaving the blade a full 3/32 in. thick to allow for finishing.

It is now to be chucked with the centre-pop running true; this can, of course, be done on the face-plate, though personally I prefer to solder it on to the faced-off end of a short scrap of round bar, or stout tube, not less than $1\frac{1}{4}$ in. diameter. This is held in the four-jaw chuck. Whichever way you do it, the centre-pop must be got to run true. In all such cases a very simple tool will help greatly, just a 4-in. length of silver-steel, say, about No. 30, pointed at each end like a centre-punch; no object in hardening it. One point goes in the centre-pop, the other in the centre of the drilling pad on the back centre. If a tool in the slide-rest is brought close to the silver-steel, not far from the centre-pop end, with a piece of white paper on the lathe bed, and a watchmaker's glass in your eye while you pull the lathe round by hand, the work can be centred dead true in a couple of minutes or less. The part beyond the boss is very handy now, either for bolting to the faceplate, or for giving extra surface for the solder.

Turn the boss to the exact sizes given, and with a small round-nose tool face off the blade to 3/32 in. thickness, coming out for an inch or so from the centre. The only dimension not given is the diameter of the smallest step on the boss; this is to be made a nice tightish fit in the $\frac{5}{16}$ in. hole in the end piece of the rocking-plate. It will eventually be soldered in the hole and afterwards keyed by drilling two holes half in the brass and half in the boss. The fit should, therefore, not be excessively tight, but sufficient to keep it properly adjusted while soldering.

The work is now transferred to the vice, and the blade is reduced to 3/32 in. thickness for its whole length. If the soldering method was adopted, the piece of bar or tube makes a convenient handle to pinch in the vice. The curves are now to be marked out. As their

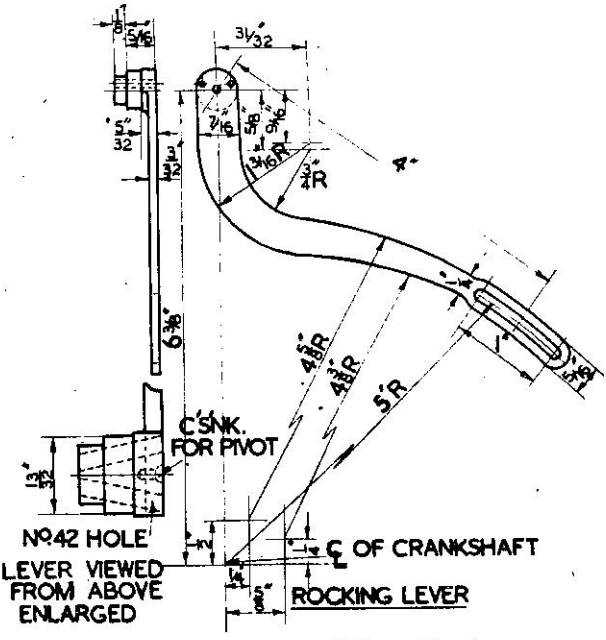


Fig. 10. Three views of the rocking-lever

*Continued from page 67, "M.E." January 17, 1946.

centres lie far away, the best way is to draw it out on a sufficiently big piece of tin or zinc, cutting it out to form a template.

Start by making the slot. This must be part of a circle whose centre is the crankshaft, 5 in. radius; otherwise when adjusting the position of the connecting-rod pin in the slot, the tilt of the rocking-plate will be altered. The slot is about $\frac{1}{8}$ in. wide, not less, as the pin has a 5 B.A. thread for a nut. Cut off the piece beyond the boss, and finish to the template.

A centre-pop has to be made on the non-boss surface corresponding to the original one on the boss. The only accurate way is to chuck a scrap of round brass rod, drill a hole and bore it to fit the 13/32 in. portion of the boss. Push the boss in against the shoulder, drill a small hole, say No. 53, to a depth of 5/32 in., and countersink it to a diameter not exceeding $\frac{1}{8}$ in. If less than that, it can easily be enlarged later when assembling the rocking-plate on its pivots.

Two holes (No. 42) must be drilled in the boss to take the electrical wires going to the terminal inclines; they are shown in the enlarged view, looking down on the top; an end view of the holes at the non-boss side is seen in the general detail drawing of the lever. They start there on a line $\frac{1}{16}$ in. above the centre, and as near the edge as possible without risk of running out. At the other end, the holes on the boss should have not more than 1/32 in. dividing them, the centre-pops being placed at a distance apart equal to the diameter of the drill plus a bare 1/32 in., and $\frac{1}{16}$ in. above the centre as at the non-boss end. The holes will be drilled from each end to meet in the middle. Start by enlarging the pops to the full diameter of the drill with a small home-made flat diamond-shaped drill; this will keep to the pop more accurately than a twist drill; hold the drill at right-angles to the surface while forming the countersinks. Then put the No. 42 drill in the chuck and drill carefully half way through, with the point of the back centre pressing against the other end. Repeat this for the second half, allowing the drill then to pass right through from end to end. The sharp edges at the boss end must be removed, to avoid damage to the insulation. At the non-boss end, the wires escape to pass down the edges of the lever; they must not encroach on either surface, there is not much clearance inside the plummer-block. Obviously, therefore, they must be given a way of escape. With the same drill in a centre-pop on the curve, a bare $\frac{1}{16}$ in. from the non-boss surface, drill into the original holes at right-angles (naturally, only a tiny distance). Then, with a round file, open up these escape holes converting them into slots, again removing the sharp edge at the junction. The wires will be passed straight through from the boss end, and then bent sharply at right-angles in the slots to emerge on the edges of the lever; they pass down to the fibre pad fixed on the lever with two 6 B.A. screws (Fig. 6 in the last issue). The points of the screws must not project beyond the surface of the lever; the pad is on the boss side. One of the fixing screws is longer than the other, and has a brass washer thick enough to take the earth wire soldered into a small hole on its edge. The live terminal screw in the fibre only, has three washers with wires, of which details will be given later.

The ornamental collars for the two trunnions are made from mild steel rod (Fig. 11). One is bored 13/32 in., to fit on the boss of the lever, the other pushes direct into the end-piece of the rocking-plate, and has a No. 53 hole, countersunk for the pivot as in the case of the lever. The thickness of the collars (5/32 in.) is important, the overall dimension $9\frac{2}{16}$ in., the same as the distance between the plummer-blocks, not yet made. The collars should be polished down to grade "O." The sharp edge round the holes in the end-pieces must be removed with a graver to make certain that the trunnions will push right home.

Both trunnions are to be tinned and wiped off quite clean of superfluous solder. The collar is pushed on to the boss of the lever, which is then pushed into the end-piece. Very carefully adjust the position of the lever; it starts vertically downwards at right-angles to the top edge of the end-piece, but the main point is that the centre of the slot is 5 in. from the centre of the crankshaft. The essentials should be accurately marked out full size on a sheet of paper, on which the end-piece and lever are laid for precise adjustment. Solder it to the end-piece, scrub with soap, and rinse. Offer it up on the paper again to make sure it is right. If there should be any slight projection of the boss through the end-piece, file it off flush, then make two centre-pops and drill holes, say, No. 48, half in the brass and half in the steel. Fit pins, gently hammer them in and file off flush. These key holes are best located on opposite sides, a little below the horizontal centre line. No keys are required for the other trunnion.

The crankshaft and its accessories come next. It is pivoted between plate "B" and a bridge on two pillars $\frac{11}{16}$ in. long × $\frac{1}{2}$ in. diameter, fixed to plate "A" by 3 B.A. screws (see Fig. 12). A bush in the bridge with a flange $\frac{1}{16}$ in. thick, gives increased surface to this important bearing. The shaft, $\frac{1}{4}$ in. silver-steel, is turned down to 11/64 in. diameter for the bearing, and $\frac{1}{4}$ in. from the shoulder another small shoulder is formed where the diameter is reduced to 9/64 in. The crank disc, a nice fit on this smallest portion, is pushed up against the shoulder with the fingers, and similarly must be able to be pulled off again with the fingers.

Make the disc first (see Fig. 13). Then set up the $\frac{1}{4}$-in. silver-steel in the four-jaw (of ample length to allow for a misfit and fresh start). Turn this smallest diameter for a distance of, say, $\frac{3}{8}$ in., up to a shoulder on the untouched $\frac{1}{4}$-in. rod, finishing with a dead smooth file, and finally with emery sticks until it is a perfect fit in the disc, finger tight. Put oil on it when trying it in the disc, and don't rotate the disc on the shaft, there is danger of "seizing." If not satisfied with the fit, cut it off and try again. When perfect, cut it to length flush with the surface of the disc when right home.

Now turn the bearing part up to a shoulder $\frac{1}{4}$ in. from the disc shoulder; this, like all other pivots, must be polished down to No. 0 emery stick. Professional watchmakers would not stop there, they use finer material, but we are "engineers," not watchmakers.

A longitudinal keyway is now to be made. Push the disc on, make a centre-pop on its face very slightly outside its bore, this will ensure the key always remaining in the disc when taken off the shaft. Drill (No. 53) till the point has gone in 5/32 in. Fit a silver-steel key by filing and polishing; it must not be so tight that you cannot pull the disc off the shaft. File the key flush with the disc.

The key will prevent the disc rotating, but a grub-screw is also required. Drill a clearance hole for No. 8 B.A. to a depth of $\frac{1}{16}$ in., at a point on the edge of the disc about 180 degrees from the key-way. Continue the hole with tapping size until it has made a countersink in the shaft for the point of the grub-screw. Pull the disc off, tap the hole, and make the grub-screw of silver-steel; the thread should stop short of the cut for the screwdriver, and when right home, the screw may project, say $\frac{1}{16}$ in., from the edge of the disc (see Fig. 13).

The crank-pin comes next; unorthodox, but with reason. Chuck a scrap of $\frac{3}{8}$-in. mild-steel; turn down to $\frac{5}{16}$ in. diameter for about $\frac{1}{2}$ in. Turn down to a full $\frac{1}{8}$ in. diameter for about $\frac{5}{16}$ in. up to a sharp shoulder. Take it out of the chuck, firstly marking the rod opposite the No. 1

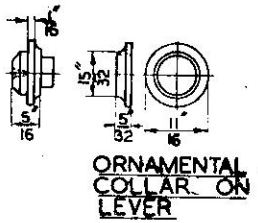


Fig. 11

jaw. Drill a small hole and broach it for a tapered pin to retain the connecting-rod. Replace in chuck according to the mark. Finish the $\frac{1}{8}$ in. portion with dead smooth file, and polish; it will then be really $\frac{1}{8}$ in. Reduce the length by filing to leave a nice-looking amount beyond the hole. Part off so as to leave a flange 1/32 in. thick. This "mushroom" is to be soldered on the crank-disc, and the parted-off surface must be quite flat; rub it on a file until it is flat and sufficiently rough to hold the solder. Tin it and wipe it clean. Wash with soap, and rinse.

Before soldering it on the disc, make a pair of small cramps like those used when making the rocking-plate, but much smaller. Cut off four bits of strip steel, $\frac{1}{4}$ in. × $\frac{1}{16}$ in., about $1\frac{1}{2}$ in. long. Use 6 B.A. screws, $\frac{1}{2}$ in. long, and place them $\frac{3}{8}$ in. from the ends. The object of having the "pushing" screw so far in is that it makes it more handy to use; holding the cramp between finger and thumb, pressing the overlapping ends together, will open the "business" end and keep the whole tool from flopping about.

File a small notch in the edge of the outside face of the crank-disc, 180 degrees from the grub-screw. This is merely to mark the position of the crank-pin (see Fig. 13). Tin the whole of this outside face; wipe clean and wash. The "mushroom" is to be soldered so that its stalk (crank-pin) gives a throw of 1/20 in., its centre being on a line joining the grub-screw and the notch, and the tapered pin parallel with that line, the larger diameter of the taper outwards away from the centre of the disc. It is helpful when assembling, to know which way to insert the pin.

Measure the exact diameter of the disc (it is supposed to be $\frac{1}{2}$ in.). If the crank-pin is $\frac{1}{8}$ in., then the outside of the pin is to be 1/20 in. plus $\frac{1}{16}$ in. from the centre of the disc, or 4/20 in. minus $\frac{1}{16}$ in. from the edge, that is $\frac{1}{8}$ in. plus 1/80 in. If we put it at $\frac{1}{8}$ in. from the edge,

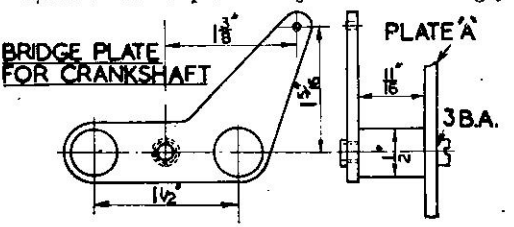


Fig. 12

it will have a shade too big a throw; that is a fault on the right side and can be accepted.

We now see the reason for soldering the pin on the disc; it is an easy matter to shift it for regulating the clock, if found necessary. This may have to be done when the clock is first tested; afterwards, the slot in the rocking-lever will allow sufficient adjustment.

Set the depth gauge to $\frac{1}{8}$ in. Place the crank-pin on the disc, with the larger end of the tapered hole outwards and coinciding with the notch. Put the cramps on lightly, one on each side, and shift the pin about till correct, then tighten the cramps; apply Baker's fluid and two little scraps of solder, heat over a spirit lamp, as supplied to doctors by chemists. Scrub with soap and rinse.

Long ago, we scribed a vertical centre line on plate "B." Drill a No. 32 hole on this line $4\frac{3}{4}$ in. from the top of the plate for the crank-shaft pivot. Drill a No. 42 hole for the armature

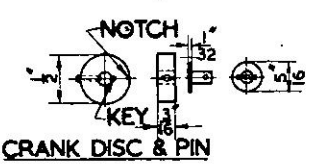


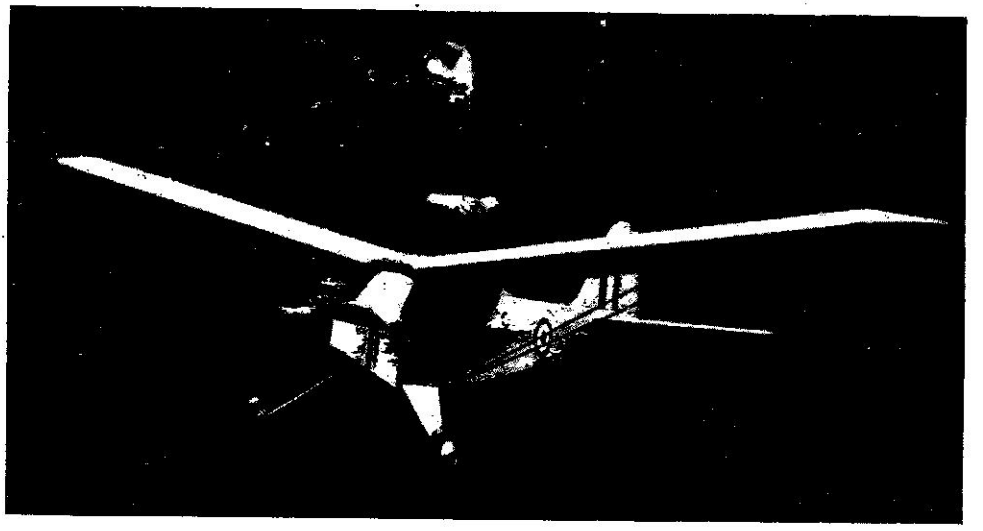
Fig. 13

pivot $1\frac{3}{8}$ in. from the centre line, and $3\frac{7}{16}$ in. from the top. Cramp plates "A" and "B" together with plugs in the pillar holes, and produce these two holes through "A." Now separate the plates and drill holes in "A" for the bridge-plate pillar screws (see Fig. 12), using a drill one size too small, to be broached later to let the screws just pass through.

Cut out the bridge-plate roughly to size, and cramp it in correct position on the inner face of "A." Produce the crankshaft pivot hole, the armature pivot hole, and the two screw holes, using "A" as a jig. Finish the edges of

(*Continued on next page*)

Models at High Wycombe



"Taylor Cub"

THE High Wycombe and District Amateur Engineering Association held, during the last week of November, a well-organised exhibition in the Public Museum of the town. Several thousands of visitors have been able to admire the numerous beautiful models.

The best exhibits were Mr. S. Wade's well-known 3½-in. gauge "Royal Scot," followed by Mr. F. Hand's "Princess Marina." Both these locomotives were run at various "VJ" children parties and fêtes.

Mr. Williams's very fine beam engine and the 2-in. scale tractor and several other steam engines were shown working under compressed air.

Great attraction was created by Mr. Vince's "OO" gauge electric G.W.R. tank locomotive, shown working.

In the "Shipping" section, a fine unfinished model clipper could be admired, the work of Mr. Gomm; and a 5-ft. ocean-going tug by Mr. Sherwood.

In the "Model Aeroplane" section, with her wings majestically spread, was the quarter-full-size "Taylor Cub," powered with twin-cylinder engine, the outstanding work of Mr. S. Wade.

The High Wycombe Technical School also displayed very good examples of tools made by the students.

The show was a great success, and much praise is due to the Hon. Secretary of the Association, Mr. E. J. Szlumper, for the part he played in the organisation of it.—A. GALEOTA.

A Congreve Clock—(*Continued from previous page*)

the bridge-plate, broach the screw holes, and enlarge the crankshaft hole to ¼ in., ready for the bush.

When enlarging holes, I personally prefer to do this with a broach in the lathe, or start with a home-made diamond-shaped drill, to make a countersink, and then follow on with a twist drill.

Remove all burrs and take the sharp edges off the holes. Make the two pillars, their ends should be slightly hollow in the centre, but with a flat surface about 1/32 in. wide all round. Make the bridge-plate bush, and push it in.

The two pivot holes in plate "A" were for use as a jig; they are no longer required. The one for the armature pivot may now be stopped up with a brass plug riveted into slight countersinks and filed off flush. The crankshaft hole will disappear if the plate is cut away to the dot and dash line shown in the side elevation (Fig. 6). This may now be done. Finally, assemble plates "A" and "B" on the pillars with the bridge-plate in place; cut off a piece of wire with its ends filed flat in the three-jaw just to fit between plate "B" and the bush in the bridge-plate, with a little end shake. This is a gauge for the length of the crankshaft between its shoulders. Mark it with a fine file, set it up true in the four-jaw, saw it off about 3/16 in. beyond the mark, turn the pivot and polish it. Make it too tight for the hole and then broach the hole to fit. There must be a little end-shake, as always with clock arbors.

(*To be continued*)

Letters

Yacht Names

DEAR SIR,—With reference to the article on "Transfers for Models," by R. Brown, I should like, as a yachtsman, to point out, not only to your contributor, but to makers of model yachts in general, that the names of yachts are seldom, if ever, carried on the bows, but on the fashion-board only, at any rate, in this country. I refer primarily, to sailing yachts, though I think it safe to say that the same applies to power yachts, at any rate to those owned by *bona-fide* yachtsmen, as opposed to those owned by owners who are not yachtsmen.

Yours faithfully,

Kearsney. A. D. EEKHOUT.

The Newcomen Engine

DEAR SIR,—With reference to the enquiry of Mr. C. Crosthwaite, in a recent issue of THE MODEL ENGINEER for authentic illustrations of actual Newcomen engines.

If he will refer to *The Engineer* for June 27th, 1919, he will find a fully illustrated article on the Newcomen engine, at Westfield, Rawmarsh, near Rotherham, and the Elsecar engine, at Elsecar, near Barnsley. These have link connections to pistons and pump rods together with cast-iron beams.

The issue of *The Engineer* for January 19th, 1917, contains a very full account of the Newcomen engine at Pentrick Colliery, Derbyshire. This has a cast-iron beam, but with arch-heads and chains to piston and pump rods.

Both of these articles show clear illustrations of the valve-gears.

In *The Engineer* for September 18th, 1931, will be found an excellent illustration of the Newcomen engine now in Henry Ford's Museum, at Dearborne.

This engine was derelict at Fairbottom, Park Bridge, Ashton-under-Lyme, until 1928, when the relics were presented to Henry Ford for his museum by the Earl of Stamford.

I would particularly recommend this illustration to your correspondent, as it is ideal for modelling, having a wooden beam with arch-heads and chains, and also because the beam is supported by a stone column, this dispensing with the engine house which was an integral part of these old engines.

While this illustration does not show the valve-gear, it is noteworthy that Henry Ford had this engine entirely reconstructed to as near the original as was possible, this being confirmed by the illustrations in "Pumping Machinery," by Henry Davey, so that your correspondent could work to the general scheme with confidence.

Trusting this information will be of use.

Yours faithfully,

Birmingham. GEO. B. ROUND.

Clubs

Blackheath Model Power Boat Club

The first meeting of 1946 of the Blackheath Model Power Boat Club, was held on January 12th, at Davenport Hall, Catford, and was well attended. A programme for the coming year was planned and meetings will be held on the second Saturday of each month, besides Sunday morning meetings at the Princess of Wales Pond. Any former members who may have lost touch with the Club, or any power boat enthusiasts who are unattached, will be welcomed. It is hoped to hold an M.P.B.A. Regatta this year, the date to be decided later.

Hon. Secretary: J. H. BENSON, 70, Broadfield Road, Catford, S.E.6.

Lincoln Model Engineering Club

At the annual general meeting, held at the Technical College, on January 7th, it was decided to draw up a post-war syllabus of lectures, visits to works, etc., and a Brains Trust, during the year. It was also proposed that in view of the large number of members who are building 2½-in. and 3½-in. gauge locomotives, that there was an urgent need for a continuous track, and a committee was elected to prepare plans for putting this into affect at the earliest possible moment. We should be pleased to hear from all locomotive enthusiasts in Lincoln and district, also any others interested in model engineering of any kind. Meetings are held on the first Monday in each month.

Hon. Sec.; G. T. SINDALL, 53, Geneva Avenue, Lincoln.

Kodak Recreation Society

Our eighth Annual Exhibition will be held at The Kodak Hall, Wealdstone, Middlesex, from Friday, June 28th, 1946, until Sunday, June 30th, inclusive.

Hon. Assist. Sec.: C. R. L. COLES, Kodak Hall, Wealdstone, Harrow, Middlesex.

The Victoria Model Steamboat Club

It is hoped that old members will now make every effort to renew acquaintances at meetings which are once again being held every Sunday, at the Lake, Victoria Park, from 10.30 a.m.

The Lake has now been cleaned, and the first Club Regatta has been fixed for Easter Sunday, April 21st. Those interested should apply to the Hon. Sec.: J. B. SKINGLEY, 238, Colney Hatch Lane, Muswell Hill, N.10. Tel.: Tud. 4408, or visit the Lake.

South London Model Engineering Society

The next meeting will be held on Sunday, February 17th, at 11 a.m., at King's College Sports Ground, Dog Kennel Hill, East Dulwich, when Mr. H. E. Baxter will give a talk on "Cinema Projection."

On Sunday, March 3rd, Mr. A. Davidson will talk on "Milling."

The mid-week meetings on February 13th and 27th, will start at 7.30 p.m.

Particulars of membership will be gladly sent on application to the Hon. Sec.: W. R. COOK, 103, Engleheart Road, Catford, S.E.6.

Orpington Model Engineering Society

This recently formed Society was glad to again welcome some half-dozen new members at its January meeting. All present enjoyed inspecting various excellent locomotives and I.C. engines. A series of talks and demonstrations are being arranged, and the Society will shortly exhibit members' models in the window of 189, High Street, Orpington, which has been kindly offered by Messrs. Sankey Limited. The date will be advertised when fixed. We still have plenty of room, and a hearty welcome to all interested in ships, aeroplanes, locomotives, I.C. engines, etc.

Those interested should contact the Hon. Sec. : W. WHITING, of 127, Repton Road, Orpington. Phone : Orpington 2183 ; or the Hon. Press Sec. : F. FLATMAN, 69, Cloonmore Avenue, Orpington.

Sale Model and Engineering Club

The Club held their annual general meeting at the Clubroom, on Monday, January 7th, in conjunction with a Hot-pot Supper. Approximately 45 members attended, constituting nearly 70 per cent. of the total membership, and officers were elected for 1946. The President, Mr. F. Highley, thanked the retiring officers for their work during the past year, and outlined the work of the Club since its inception in June, 1944, mentioning in particular, the successful exhibition held in June, 1945, wherein £117 was raised for local charity.

Hon. Sec.: Mr. J. GRIFFITHS, 95, Northenden Road, Sale.

Romford Model Engineering Club

We have now moved to our new headquarters at Red Triangle Club (Masonic Hall), Western Road, Romford, at which address our bi-monthly meetings, on 1st and 3rd Thursdays, are held, at 8 p.m. Our new hon. secretary, to whom all enquiries should be sent, is Mr. F. E. MARKHAM, 38, Kent Drive, Hornchurch, Essex.

Leeds Model Railway and Engineering Society

The next meeting will be held on Sunday, February 3rd, at Kidmore Street. The meeting will be devoted to work on the making of additional lengths of rail, for the miniature railway.

Hon. Sec. : J. W. SEYMOUR, 12, Outwood Walk, Horsforth.

The Godalming and District Society of Model Engineers

An exhibition and competition of members' models was held on January 6th ; about 30 models were on view.

The challenge cup was awarded to a Southern "M.7" tank locomotive in 3½-in. gauge ; second prize went to a 25-c.c. horizontal twin supercharged car engine ; third was a vertical steam engine, 1½-in. bore, 1¼-in. stroke ; fourth went to a Southern "Schools" class locomotive, and the fifth award was to a "Princess Royal" locomotive.

Our grateful thanks are due to Mr. G. F. Tonnstein, of Malden ; Mr. R. Slade, of Staines, and Messrs. Pledger and Walker, A.M.I.M.E., of Vickers M.E.S., for the able judging they did for our show.

Next meeting, at 7.30 p.m., on February 3rd, at the Broadwater Hotel, Meadrow, Farncombe.

Hon. Sec. : J. BOURREL, Surrey House, High Street, Cranleigh.

Mancunian Model Engineering Society

Our 5-in. gauge Mogul has reached the assembly stage, and we also have a multi-gauge track under construction. Lectures and other items of interest are being arranged. Visitors are welcome any Friday evening, 8 p.m., Girls' Institute, Mill Street, Ancoats.

Hon. Sec. : J. R. WOOD, 1, East Road, Gorton, Manchester 18.

The Bristol Society of Model and Experimental Engineers

Our meeting on Saturday, the 5th inst., was well attended, and an interesting time was spent in discussing the opening of the Bristol Joint Model Clubs' Exhibition.

Our next meeting will be held on February 2nd.

Hon. Sec. : C. C. LUCY, 28, Bibury Avenue, Henlease, Bristol.

Warrington Model Aero and Engineering Society

The next meeting, to be held on February 1st, will be our first "annual general," and we would like members to make a special effort to attend.

Meetings are held every third Friday, at 7.0 p.m., in the Technical Institute, Palmyra Square. Next meetings : February 1st, February 22nd, March 15th. Don't forget to bring your "bits and pieces."

Hon. Sec. : F. DUNSTAN, 7, Heath Road, Penketh, Near Warrington.

Coventry Society of Model and Experimental Engineers

The unusual subject discussed at the meeting held on January 18th attracted a good attendance. Our committee have, since the annual general meeting, arranged for the Society to meet fortnightly. A Model Night is to be held on February 1st, at 6.45 p.m., at which a full attendance is requested, to discuss the possibility of holding an exhibition later in the year.

Hon. Secretary : Mr. J. F. BACK, 3, Macaulay Road, Stoke, Coventry.

Preston Society of Model Engineers

After six years of disbandment we are starting up again with a meeting to be held on February 2nd. All interested are cordially invited, and should contact the Secretary : A. HARDMAN, 4, Nook Crescent, Grimsargh, near Preston.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to Percival Marshall and Co. Ltd., Cordwallis Works, Maidenhead, Berks.

All correspondence relating to advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," Cordwallis Works, Maidenhead, Berks.

"THE MODEL ENGINEER"
SALES AND WANTS

Private: **Threepence** *word.* *Trade*: **Sixpence** *word.* *Use of Box* **2/6** *extra.*
Minimum charge, **3/-**

TOOLS & WORKSHOP

Buck and Ryan's Department for Lathes, Drilling Machines, Grinders, Electric Tools, Chucks, Surface Plates, Lathe Accessories and Tools.—310-312, Euston Road, London, N.W.1. Telephone: EUSton 4661. Hours of Business: 8.30 to 5.0 p.m., Monday to Friday; Saturday, 1.0 p.m.

For Consistent Quality, friendly service and prompt deliveries—GARNERS, Sheffield Road, Barnsley. 'Phone 2866.

Split Chucks for watchmakers lathes, 6 mm., 6½ mm., and 8 mm., 6s. each; Step Chucks, set of five, £2 17s. 6d. Draw in Spindles, 12s. 6d. each. Postage extra 6d. Larger chucks made to order. —JOHN MORRIS (CLERKENWELL) LTD., 64, Clerkenwell Road, E.C.1.

Taps, Dies, Reamers and Drills. Largest stock in the North.—GARNERS, Sheffield Road, Barnsley. 'Phone 2866.

Corbett's (Lathes), Stanton Hill, Mansfield, offer Lathes; Lathe and Drill Chucks, Electric Motors, high speed and Wimet tipped carbide lathe tools, 0-½" capacity five speed power bench drills, Wolf portable drills, treadle and electric grinders, vices, bench and machine, six hole leather punches. Copper tube, sheet, rounds, hexagons, silver solder, brazing blowlamps, etc. State requirements and include S.A.E. for lists.

Allgood for Screws, Nus, Small Tools. All enquiries, S.A.E.—"Greenside," Eastmead Avenue, Greenford, Middx.

Your Myford Specialists, 100 per cent. replacements service.—GARNERS, Sheffield Road, Barnsley. 'Phone 2866.

Tenders Invited for supply of Hydrofoils in aluminium strip. Widths 3", 2", and 1½", flat under and simple camber above. Price per linear foot—see my advert. "M.E." 3rd January.—HYDROFIN, 1, Mornington Avenue, London, W.14.

Wanted—Drills, Taps, Reamers, Milling Tools, Countersinks, Mandrels, etc.—H.S.S., Box No. 3878, MODEL ENGINEER Offices.

Hexagon M.S. for Scale Nuts and Bolts. Sizes A/F ¼", 2d.; 5/32", 3d.; 3/16", 4d.; 7/32", 5d., and ¼", 6d. per foot. Post extra. Orders over £1, post free.—J. STEPHREYS, 37, Khartoum Road, Ilford, Essex.

Moore and Wright Tools and Myford Lathe Spares in Stock. Monitor Paraffin Blowlamps, carriage paid, 29s. 6d. Union Wall Hand Power Drilling Machines, automatic feed, ½ h.p. single phase Electric Forge Blower, A.C. All model makers tools.—EDWARDS & Co., 131, Magdalen Road, Exeter, 56134. Lic. 1527.

Tungsten Carbide Tipped Lathe Tools, suitable for any metal. Turning rough castings easy. Square shanks, round nose, ¼", 3s. 9d.; 5/16", 4s. 3d.; ⅜", 4s. 9d., postage 3d. each.—144, Padgate Lane, Warrington.

Machine Tools. Lathes, 5" Atlas, 5" Sheldon, 7" Colchester Triumph, 8" Monarc 6" New Wonder, 6" Holbrook, 8" Tool Room Lathe, all-geared head, 16½" Lodge all-geared, motorised. Capstans, 3A Ward, motorised, 2A Ward, motorised; several 1½" Wards, roller bearing heads, £70; No. 4 Herbert, geared head Exacta ⅝" motorised; also 3 Surface Grinders, Pallas motorised Miller, Brown & Sharpe 2-g. auto Denbigh Miller, Pratt & Whitney automatic Millers, Fly Presses, etc. May be inspected any time, including week-ends, by appointment.—VICTA ENGINEERING Co., Maidenhead. 'Phone 50.

½ H.P. Crypto Motor, 210 v., 1 phase, with patent starter, 2,800 r.p.m., with spindle each side, £9; Union Tool Grinder, F. & E. Pulley for 1½" belt, 2 6" wheels, guarded; £2 5s.; 1 Millennium Garage Jack, £3; 1 No. 3A Jacobs Chuck, No. 2 M.T., ½"-⅝", new, £1 5s.; 1 No. 1A Jacobs Chuck, 0-¼" new, 10s.—34, Kingsholm Road, Southmead, Bristol.

ELECTRICAL EQUIPMENT

A.C. Motors, 1/50th h.p. to 10 h.p., from stock; also D.C.—JOHNSON ENGINEERING, 86, Great Portland Street, London, W.1. Museum 6373.

Electradix Bargains include:

Dynamo and Motor Generator Bargains. G.E.C. double current Dynamos, 6 volts, 5 amps., 600 volts, 80 m.a. ball-bearings, 17 lb., as new, 37s. 6d., carriage paid, 5s. refunded on returned packing case.—Below.

Small D.C./A.C. Motor Generators by leading makers for use in Radio Receivers to take the place of H.T. battery, 6 volts input, 10 volts, 15 m.a. output, or 12 volts input, 230 volts, 30 m.a. output, £3 15s., weight only 5½ lb., size 5¾" × 3½" × 3¾", model finish, ball-bearings, 2-comms., 2 separate windings, waterproofed.—Below.

Transformers, 3 K.W. Crypto, 230 volts to 115 volts, 28 amps., £9 10s., to small Bell Transformers, 230/3/58 volts, 7s. 6d. Transformers for Rewind, 3 K.W. with stampings 4½" × 6" × 7½", windings damaged by blitz, weight with damaged wire, 65 lb., 45s., carriage extra.—ELECTRADIX, 214, Queenstown Road, London, S.W.8.

Brand New A.C. Motors, 200/250 volts, high starting torque, ¼ h.p., £5; 1/3 h.p., £5 10s. All sizes available.—JOHN STEEL, Bingley, Yorks.

Wanted, Universal Avominor, or similar.—LEE, 26, Oxford Street, Belle Vue, Wakefield, Yorks.

MODELS & FITTINGS

Apex Minor (Mr. Westbury's design) engine castings, also carburettor castings "M.E." June 14th issue. Delivery from stock. Also spiral timing gears. New Atom Minor 6 c.c. (Mr. Westbury's design). Patterns and castings in preparation. Orders booked in strict rotation. Trade enquiries invited.—THE HEADINGLEY MOTOR & ENGINEERING Co. LTD., 8, Otley Road, Leeds.

Are you stuck, that tricky piece of machining, that hull that won't come right? Send it to us. A first class job at a reasonable price. No job too big or too small; 0" and ¼" rolling stock built to order.—TAYLOR, 10, Mount Pleasant Road, Brixham, S. Devon.

Ship Modellers. Model Wire Ropes in Phosphor-Bronze, .016, 4s. 0d.; .019, 4s. 2d.; .022, 4s. 4d.; .024, 5s. per 75 ft. coil; .020 galvanised, 3s. 6d.—DAVIES, 4, Dauntesey Avenue, Blackpool, Lancs.

For Sale, 2½" gauge 4-6-2 Chassis, all steel, fully sprung. Engine partly finished.—MANSON, 54, Charlton Lane, Cheltenham.

New, ½" Globe Valve, 6s.; ½" Check Valve, 3s. 6d.; ⅜" Plain Water Gauge, 4s. 3d.—THOMAS MCCRACKEN, 388, Main Street, Rutherglen.

For Sale, 2½" 4-6-0 partly finished, Tender complete; also Bat, partly finished, £6 the two.—SEXTON, 543, Holloway Road, London, N.19.

Garden Railway Train, in good going order, 7½" gauge.—Box No. 3879, MODEL ENGINEER Offices.

Horizontal Steam Engine 2" × 4", ditto 1" × 2", also 3 Cylinder Boat Engine, reasonable offers, S.A.E. for particulars.—JAMES RODGERS, 14, Hamilton Road, Bathgate, West Lothian.

Boiler Brazing and Building Service. Boilers brazed or built to your own or "L.B.S.C." specification, tested and guaranteed. Personal attention to all orders. Send stamped addressed envelope for quotation against sketch or drawing, and list of Easyflow and Silbrallov, etc.—CLARABUT, 6, Park Road, Wembley.

Slide Valve Gun Metal Cylinder, best finish, 1⅛" × 2½", new, £2; Stuart C.I. 2" cylinder, machined, £1; set of Hot-air Engine Castings, copper vertical boiler, steel crankshafts, few boiler cocks, new. S.A.E.—DAVEY, 118, Deacon Road, Bitterne, Southampton.

GENERAL

Watchmakers Demobbed, need Lathes to start work again. John Morris (Clerkenwell) Ltd., will pay high prices for Lathes by Lorch, Boley, Wolf Jahn, and American and Swiss makes.—64, Clerkenwell Road, E.C.1. CLE 6077.

Watch and Clock Making. If interested you can get all tools and parts, also wheels cut from—JOHN MORRIS, 64, Clerkenwell Road, E.C.1. Regret no posts or lists, only counter service at present.

Toys, Models and Novelties. Book of designs with instructions. 50 illustrations. Popular number, 2s. 6d., post free.—HARROD (M), 10, Beaconsfield Road, Maidstone.

Metal Moulds for Lead Toys, deep cut, supplied in over 200 latest designs. Satisfaction guaranteed. S.A.E. for lists. —AGASER, 7, Stradbroke Road, London, N.5.

Car Thermometers, pre-war (Smiths Instruments), dash reading, flushfitting, give immediate warning of engine trouble, etc., 35s., new.—TEDDINGTON ENGINEERING Co., High Street, Teddington, Mddx. Kingston 1193-4.

Modeller's Scaled Rule, brass, 12" long, engraved 7, 4, 3½ and 2 mm. scales; indispensable to the model engineer, 2s. 6d., post free; "Cardboard Rolling Stock and How to Build It," 2s. 9d., post free.—E. RANKINE GRAY, 691, Christchurch Road, Boscombe, Hants.

Model Engineers. No matter how small your problems, why not write to your Consultants. Tell us the Ship, Marine Engine, Locomotive, Track or Materials, and we will supply plans or advise where to purchase. Advice, 3s. 6d. Quotations free, S.A.E., by practical Model Engineer. Est. 1919.—WILSON, MACDUFF & Co. LTD., 5, Victoria Street, London, S.W.1.

Wanted, "Model Engineers" for 1945.—KENDALL, 106, Rugby Road, Binley, Coventry.

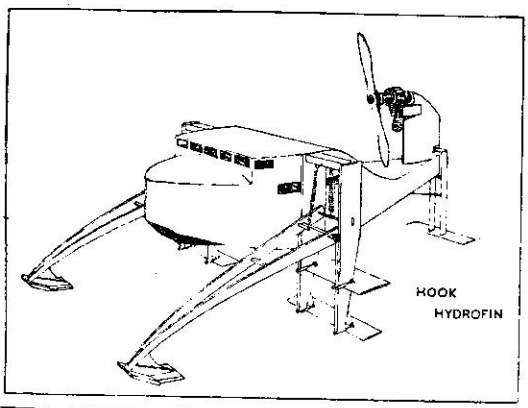
Advertiser Desires Drawings for 1¼" or 1½" scale Showman's Traction Engine. Particulars to—PARKE, 86th Field Hygiene Section, R.A.M.C., C.M.F.

35 mm. Cinema Films, Comedies, Travel, and Features. Prices from 13s. 6d. reel. All in first class running order and post paid. Stamp for list.—COLLINGWOOD, 17, The Grove, Coxhoe, Ferryhill, Durham.

"Mechanics," 225 Nos. from Nov., 1936, containing Green Arrow, Gwen Elms, and others, 45s.; "Practical Engineering," 215 Nos., 45s., carriage extra.—164, King Edward Road, Swansea.

Mr. G. R. de Havilland would like to purchase "Locomotives" in two volumes, by A. Morton Bell. Also, urgently required—Stewart Turner small 4-6 volt Dynamo. Please write to—THE DE HAVILLAND AIRCRAFT Co. LTD., Hatfield, Herts.

Baker Valve Gear Blueprint wanted, 1" and ½" scales. Buy or loan.—MCKENZIE, 8, Fettes Row, Edinburgh 3.



The Hook Hydrofin—

1st Prize and Gold Medal, Paris, 1945

You were born too late to be a pioneer of Aviation, but you can still become a pioneer of this **NEW BRANCH OF SCIENCE . . . . HYDROFINS.**

The **HYDROFIN** is the modern sea-going version of the Hydrofoil boat, that is to say, a craft that runs on submerged fins which lift the hull entirely clear of the water. Very high speed for low power, safety and better seaworthy qualities than the classical boat are the main advantages of the **HYDROFIN.** Build your own model now with inventor's licence.

Drawings, rubber-driven model 1 ft. 9 in. ... 5 -
" petrol- " " 3 ft. 0 in. ... 7 -
Post Free.

HYDROFIN PLANS SERVICE
1, MORNINGTON AVENUE, LONDON, W.14

WE TENDER OUR REGRETS

To those who were unable to secure a copy of the January issue of

MODEL AIRCRAFT

(The official journal of the S.M.A.E.)

The demand was overwhelming and supplies being limited by paper rationing, proved completely insufficient to meet it.

If you were one of the unlucky ones, we suggest you apply to be placed on the waiting list, either with your usual supplier, or by direct subscription (13/6 per annum, post free) to the publishers :

PERCIVAL MARSHALL & CO. LTD.
23, Gt. Queen Street, W.C.2
and at Maidenhead, Berks.

The Premier Engine of the Country
THE "WHIRLWIND SIX"

Built like a Rolls Royce by expert Model Engineers.

Weight 6½ ozs., 6 c.c.

Fly any model up to 6 ft. wing span.

The engine with a 1,000 hour Bench and Flying test.

Accessories include coil, condenser mountings, plug, and plastic tank, etc.

Sold complete.

Interchangeability of parts guaranteed.

Spares obtainable for every part.

Service and Advice Dept. will help you with your problems at all times.

Enquiries invited for agents.

Sole manufacturers :—

JENCO ENGINEERING CO. LTD.
43, CASTLE STREET,
HINCKLEY. LEICS.

FOYLES
*** * FOR BOOKS * ***

LARGEST BOOKSHOP IN THE WORLD

- Over 3,000,000 books in stock
- New and secondhand books on every subject
- —— Catalogues free ——
- Any book sent on approval

BOOKS BOUGHT

119-125, CHARING CROSS RD., LONDON, W.C.2
OPEN DAILY, 9a.m.-6p.m., including Saturdays
Tel. GER. 5660 (16 lines). Tel. Foylibra, Westcent, London

G.N. MODELS, SOUTHAMPTON

We are builders of Locomotive Models in all gauges. Showmen's and Traction Engines up to 3-in. scale, locomotive, stationary, and marine boilers.
We can supply castings, materials, and finished parts for all "L.B.S.C." locomotives.
Designs prepared from Customers' rough sketches or Specifications.
Inventor's and Demonstration Models, 3-in. scale, Traction Engine Drawings, Castings and Finished Parts can be supplied at very short notice.
Let us know your requirements. We can probably meet them.

Registered Office :—
170, Bluebell Road, Swaythling, Southampton.

And at :—
19, Middlebridge Street, Romsey, Hants.

LET ME BE YOUR FATHER

You need help and Fatherly advice in difficult times like these. I am in the position to give that to you free.

We teach nearly all Trades and Professions by Post in all parts of the World. The most progressive and most successful correspondence College in the World.

If you know what you want to study, write for prospectus. If you are undecided write for my Fatherly advice, it is Free. Distance makes no difference.

Do any of these subjects interest you ?

Accountancy Examinations
Advertising and Sales Management
Agriculture
A.M.I. Fire E. Examinations
Applied Mechanics
Army Certificates
Auctioneers and Estate Agents
Aviation Engineering
Aviation Wireless
Banking
Blue Prints
Boilers
Book-keeping, Accountancy, and Modern Business Methods
B.Sc.(Eng.)
Builders' Quantities
Building, Architecture and Clerk of Works
Cambridge Senior School Certificate
Civil Engineering
Civil Service
All Commercial Subjects
Commercial Art
Common Prelim. E.J.E.B.
Concrete and Structural Engineering
Draughtsmanship. All branches
Engineering. All branches, Subjects and Examinations
General Education
G.P.O. Eng. Dept.
Heating and Ventilating
Industrial Chemistry
Institute of Housing
Insurance
Journalism
Languages
Mathematics
Matriculation
Metallurgy
Mining. All Subjects
Mining. Electrical Engineering
Motor Engineering
Motor Trade
Municipal and County Engineers
Naval Architecture
Novel Writing
Pattern Making
Play Writing
Police, Special Course
Preceptors, College of
Press Tool Work
Production Engineering
Pumps and Pumping Machinery
Radio Communication
Radio Service Engineering
R.A.F. Special Courses
Road Making and Maintenance
Salesmanship, I.S.M.A.
Sanitation
School 'Attendance Officer
Secretarial Examinations
Sheet Metal Work
Shipbuilding
Shorthand (Pitman's)
Short Story Writing
Speaking in Public
Structural Engineering
Surveying
Teachers of Handicrafts
Telephony and Telegraphy
Television
Transport Inst. Examinations
Viewers, Gaugers, Inspectors
Weights and Measures Inspectors
Welding
Wireless Telegraphy and Telephony
Works Managers

If you do not see your own requirements above, write to us on any subject. Full particulars free.

Direct Mail to—

Dept. 17,
THE BENNETT COLLEGE,
SHEFFIELD.

Progress

On sale Christmas 1945

Induction Coils—4 & 6 Volt Transformers, 4/6 Volt Electric Bells—Bell Pushes and Switches—Battery Testers—Plastic and Metal Bulb Holders—and our well-known Morse Practice Keys and Buzzers

Coming in 1946

(in the order in which they should be ready)

Pocket Compasses—Plastic Stamp Magnifiers—4 Volt Electric Motors—Plastic Telescopes—Microscopes—Model Steam Engines—Electrical Outfits—Model Dynamos—6 and 20 Volt Electric Motors—20 3½ Volt Transformers—Model Sewing Machines

To avoid disappointment please book your orders as early as possible

SIGNALLING EQUIPMENT LTD
Merit House, Southgate Road
Potters Bar, Middlesex

Telephone : Potters Bar 3133/4
Cables and Telegrams : "SEL., Potters Bar"

THE **FLUXITE GUN**

is always ready to put Fluxite on the soldering job instantly.

PRICE 1/6 or filled 2/6

FLUXITE

(SIMPLIFIES SOLDERING)

PASTE

Is the most effective flux invented and has been used for over 30 years in Government works. It is also used for case hardening and for tempering steel. Ask for leaflets, also Free Book "The Art of Soft Soldering."

Of all Ironmongers, in tins, 8d., 1/4, 2/8

FLUXITE POCKET BLOW LAMP,
Price 2/6.

FLUXITE LTD., Dept. 79, Dragon Works, Bermondsey Street, S.E.1.

Printed in Great Britain for the Proprietors by ELECTRICAL PRESS, LTD., Cordwallis Works, Maidenhead, Berks., and published by PERCIVAL MARSHALL & CO., LTD., Cordwallis Works, Maidenhead, Berks.